Benchmarking optimization methods for parameter estimation in large kinetic models: RESULTS SUPPLEMENT

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1 Computational settings

1.1 Hardware and Software setup

The results presented here were obtained in a computer cluster using 20-core nodes with 32 GB of RAM, Intel Xeon CPU 2.50GHz. The Linux distribution was Rocks Clusters 6.1.1 (Sand Boa), based upon CentOS 6.5. Calculations were performed in MATLAB R2015a (64bit), using the AMICI 0.4.0 toolbox and GCC 4.9.4 compiler.

Calculations were independently reproduced in a cluster using 16-core nodes with 24 GB of RAM, Intel Xeon CPU 2.40GHz. The Linux distribution was Fedora25. Calculations were performed in MATLAB R2017a (64bit), using the AMICI 0.4.0 toolbox and GCC 6.4.1 compiler.

1.2 Thresholds: maximum CPU time (MAXT) and value to reach (VTR)

Table S1: Different sets of maximum computation time and values to reach (VTR) for the objective function of every benchmark. VTR C is a meaningful choice for a "good enough" solution, and it is the one used in the results reported in the main text and in Sections 2 and 3 in this document. VTRs A, B, and D are more relaxed or strict variants, obtained by multiplying VTR C by 0.5, 0.75, and 1.5, respectively. VTRs E, F, G, H, and I are set by adding different offsets to the best objective function found by any algorithm for each benchmark (fbest). Section 4 shows results obtained with all VTRs and MAXTs

	B2	B3	B4	B5	BM1	BM3	TSP
MAXT A	10000	100000	10000	10000	1000	100000	3600
MAXT B (= A · 0.5)	5000	50000	5000	5000	500	50000	1800
VTR A	650	110	250	4500	150	75	1948
VTR B (= A · 1.5)	975	165	375	6750	225	112.5	2922
VTR C (= A · 2)	1300	220	500	9000	300	150	3896
VTR D (= A · 3)	1950	330	750	13500	450	225	5844
fbest	400.182	14.0845	30.2526	7653.61	125.515	116.479	2613.60
VTR E (= fbest + 0.1)	400.282	14.1845	30.3526	7653.71	125.615	116.579	2613.70
VTR F (= fbest + 1)	401.182	15.0845	31.2526	7654.61	126.515	117.479	2614.60
VTR G (= fbest + 10)	410.182	24.0845	40.2526	7663.61	135.515	126.479	2623.60
VTR H (= fbest + 100)	500.182	114.085	130.253	7753.61	225.515	216.479	2713.60
VTR I (= fbest + 1000)	1400.18	1014.08	1030.25	8653.61	1125.52	1116.48	3613.60

1.3 Settings of the eSS algorithm

Table S2: Settings of the eSS algorithm: population sizes for each benchmark. No other settings were tuned in the optimizations. The 'auto' setting corresponds to the default value calculated by the eSS algorithm as a function of the problem size. Note that some population sizes of the largest benchmarks were set to values lower than the default ones. In those cases the time spent by eSS in evaluating the candidate solutions included in the populations does not always translate into substantial improvements of the best objective function.

Option	B2	B3	B4	B5	BM1	BM3	TSP
Initial population size ('ndiverse')	auto	500	auto	auto	100	1000	auto
Reference set ('dim_refset')	auto	auto	auto	auto	20	100	auto

2 Results: Histograms and dispersion plots of the multi-starts of local searches (MS)

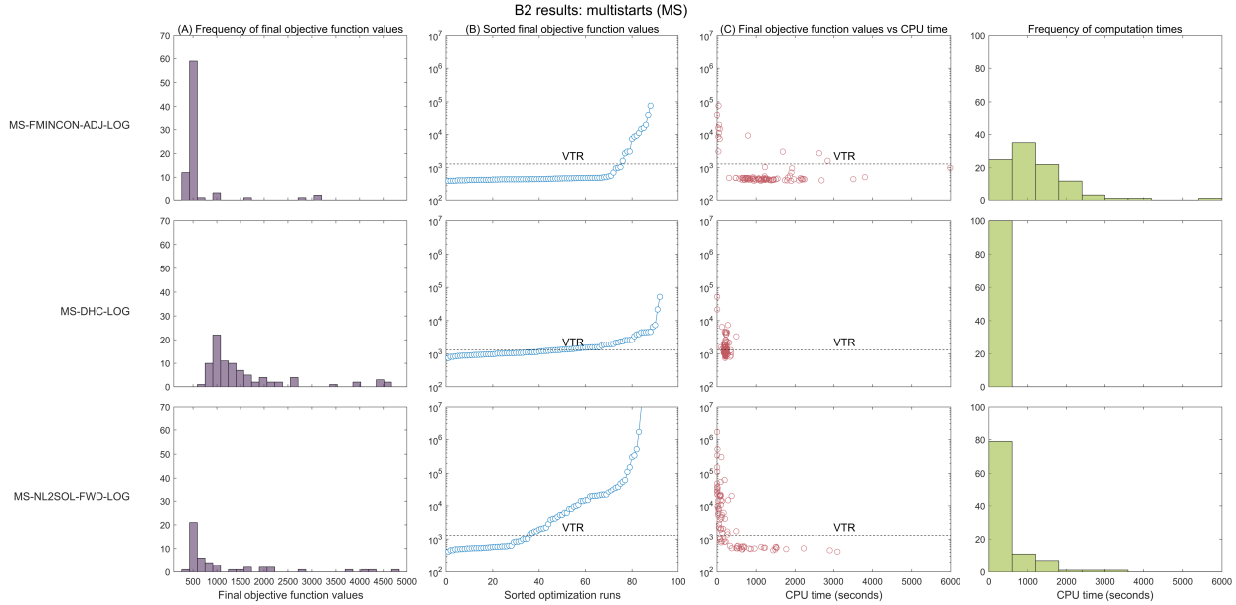

Figure S1: Results of multi-start of local searches for benchmark B2 (LOG). The VTR used is VTR C in Table S1.

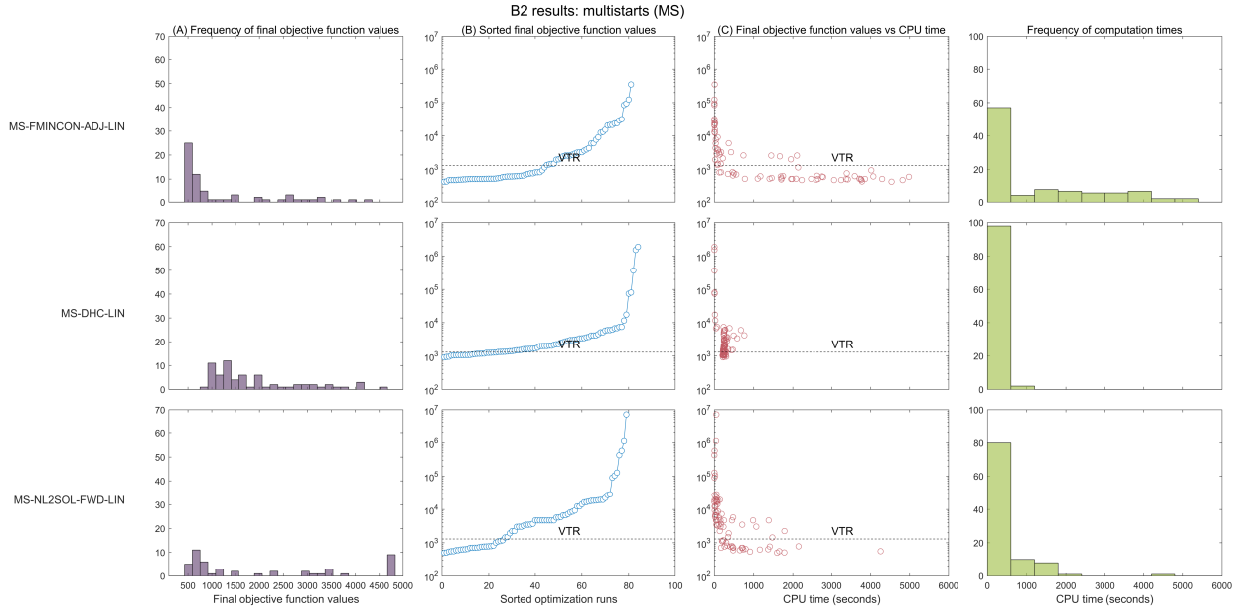

Figure S2: Results of multi-start of local searches for benchmark B2 (LIN). The VTR used is VTR C in Table S1.

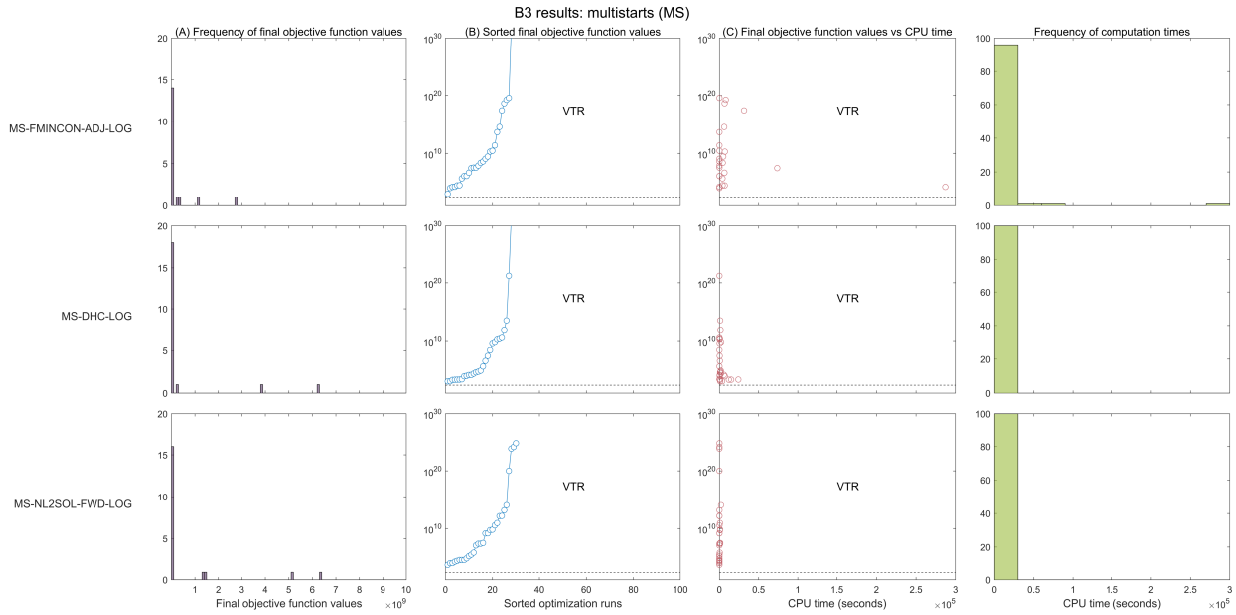

Figure S3: Results of multi-start of local searches for benchmark B3 (LOG). The VTR used is VTR C in Table S1.

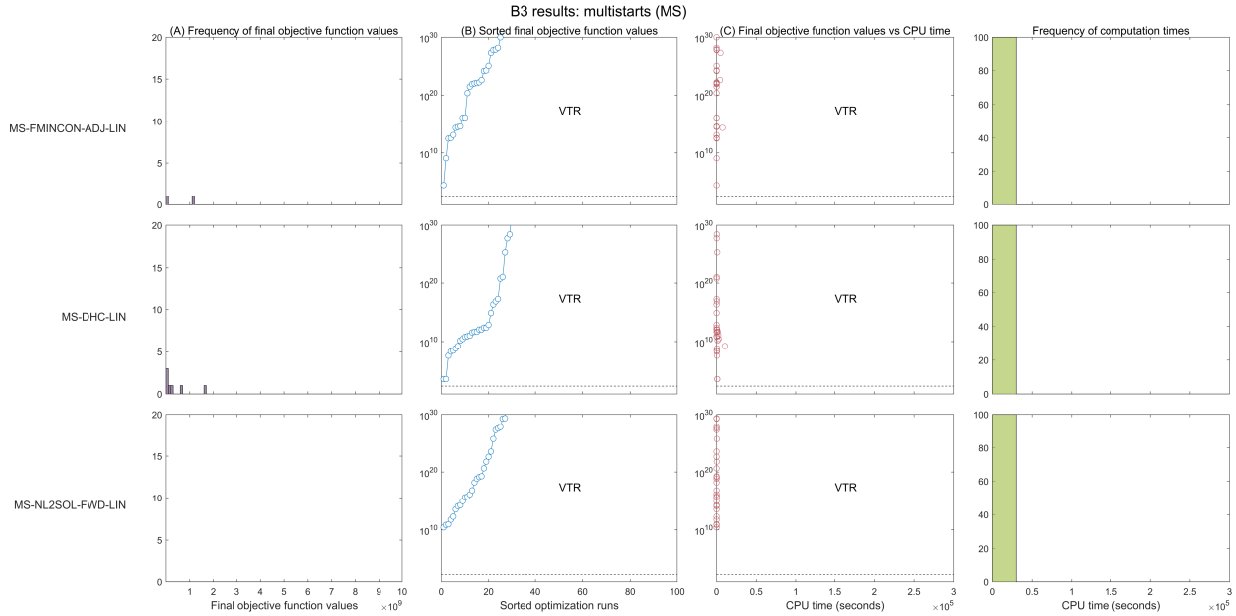

Figure S4: Results of multi-start of local searches for benchmark B3 (LIN). The VTR used is VTR C in Table S1.

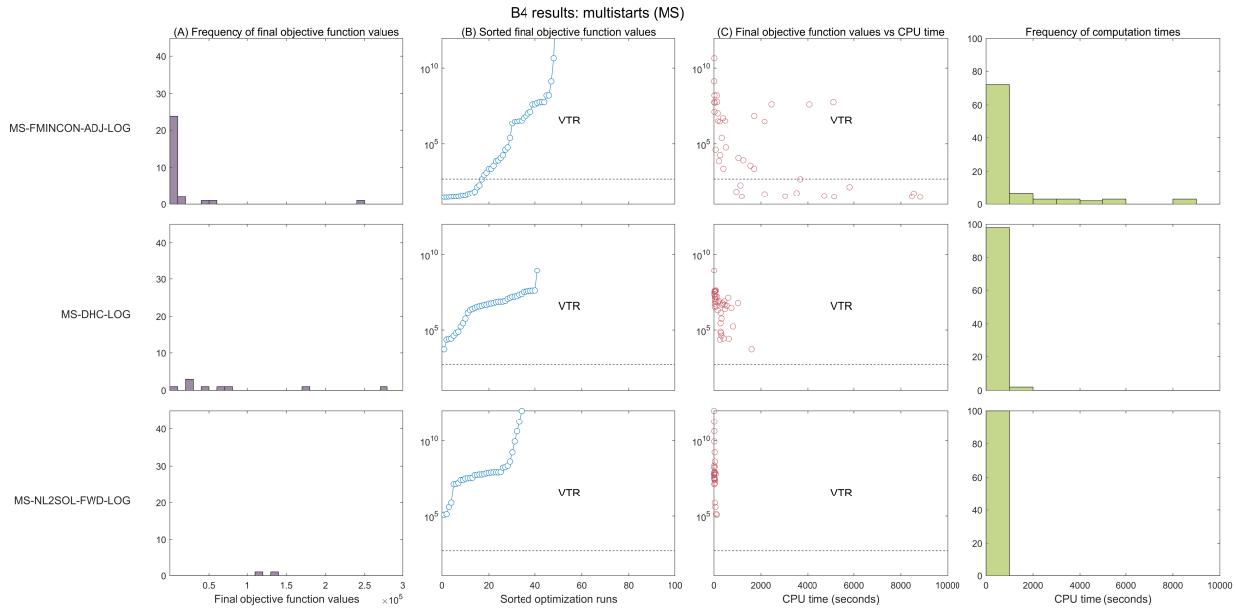

Figure S5: Results of multi-start of local searches for benchmark B4 (LOG). The VTR used is VTR C in Table S1.

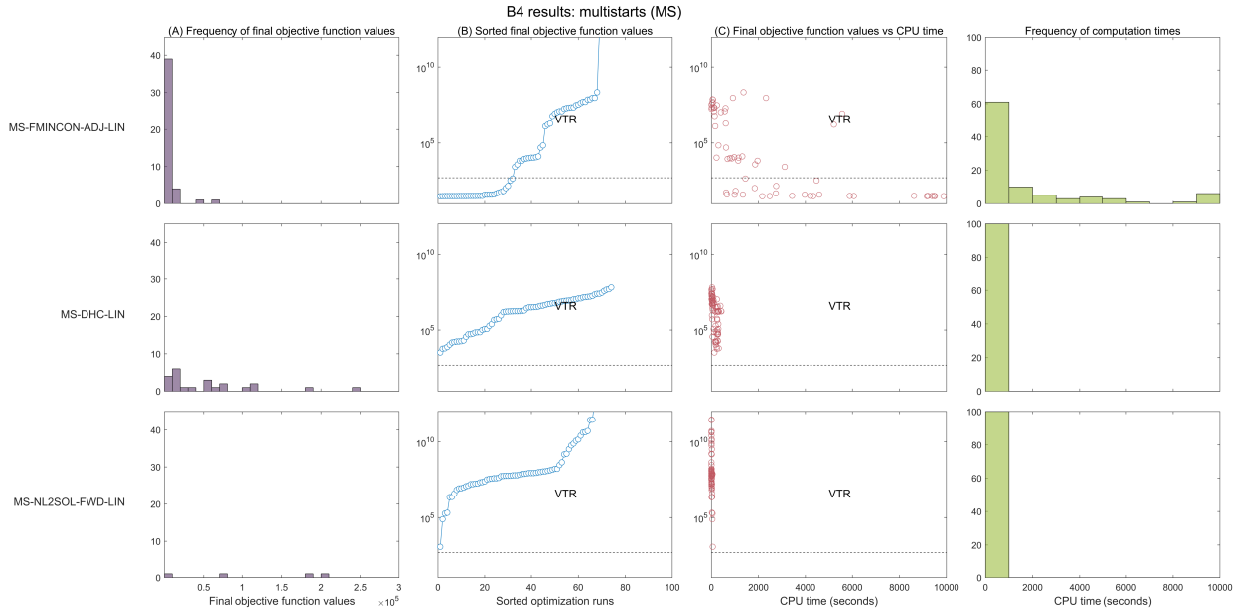

Figure S6: Results of multi-start of local searches for benchmark B4 (LIN). The VTR used is VTR C in Table S1.

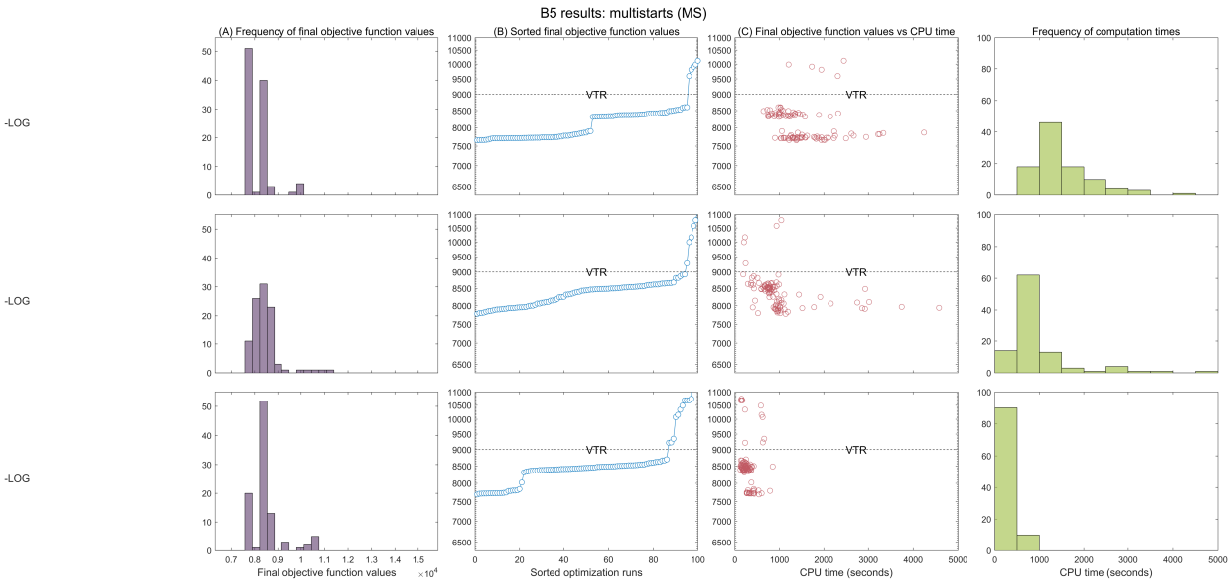

Figure S7: Results of multi-start of local searches for benchmark B5 (LOG). The VTR used is VTR C in Table S1.

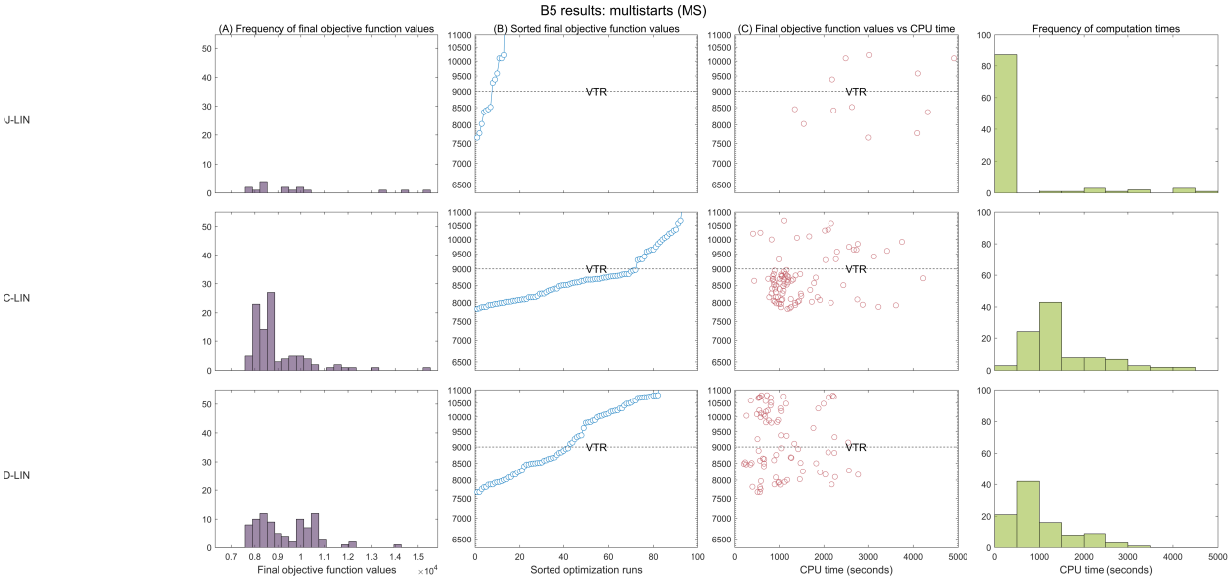

Figure S8: Results of multi-start of local searches for benchmark B5 (LIN). The VTR used is VTR C in Table S1.

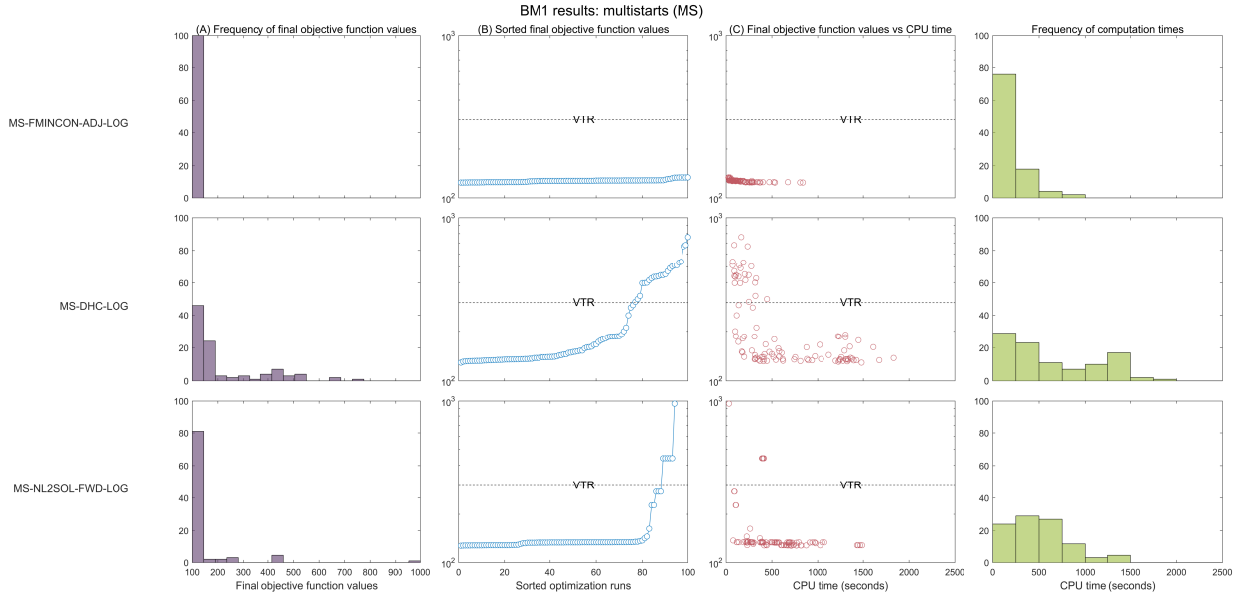

Figure S9: Results of multi-start of local searches for benchmark BM1 (LOG). The VTR used is VTR C in Table S1.

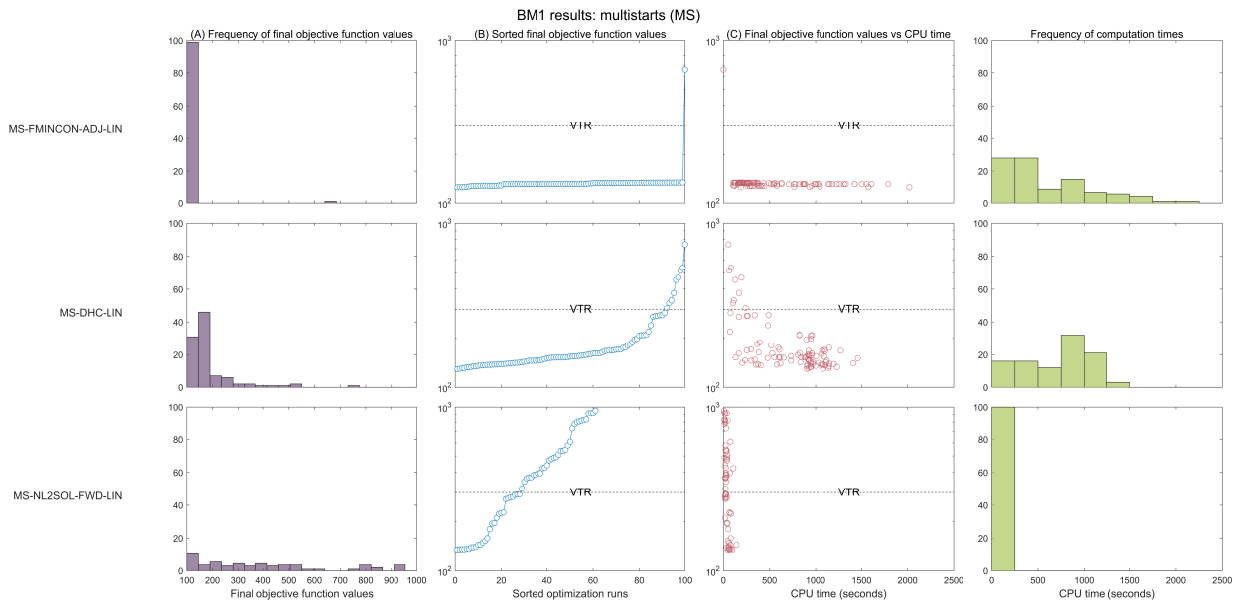

Figure S10: Results of multi-start of local searches for benchmark BM1 (LIN). The VTR used is VTR C in Table S1.

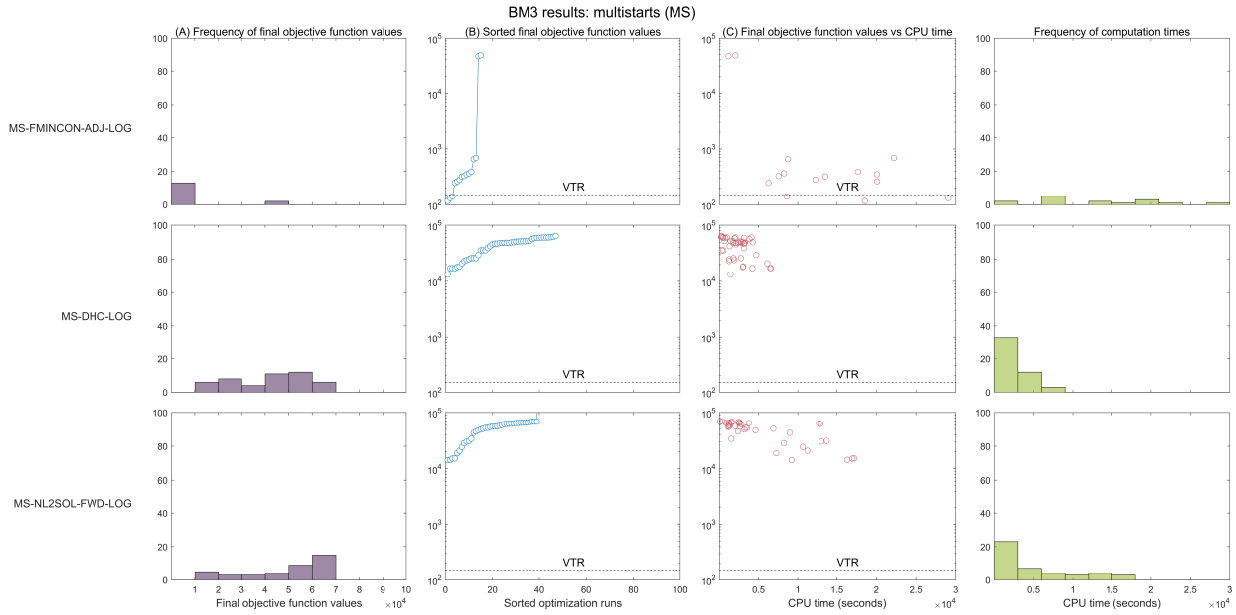

Figure S11: Results of multi-start of local searches for benchmark BM3 (LOG). The VTR used is VTR C in Table S1.

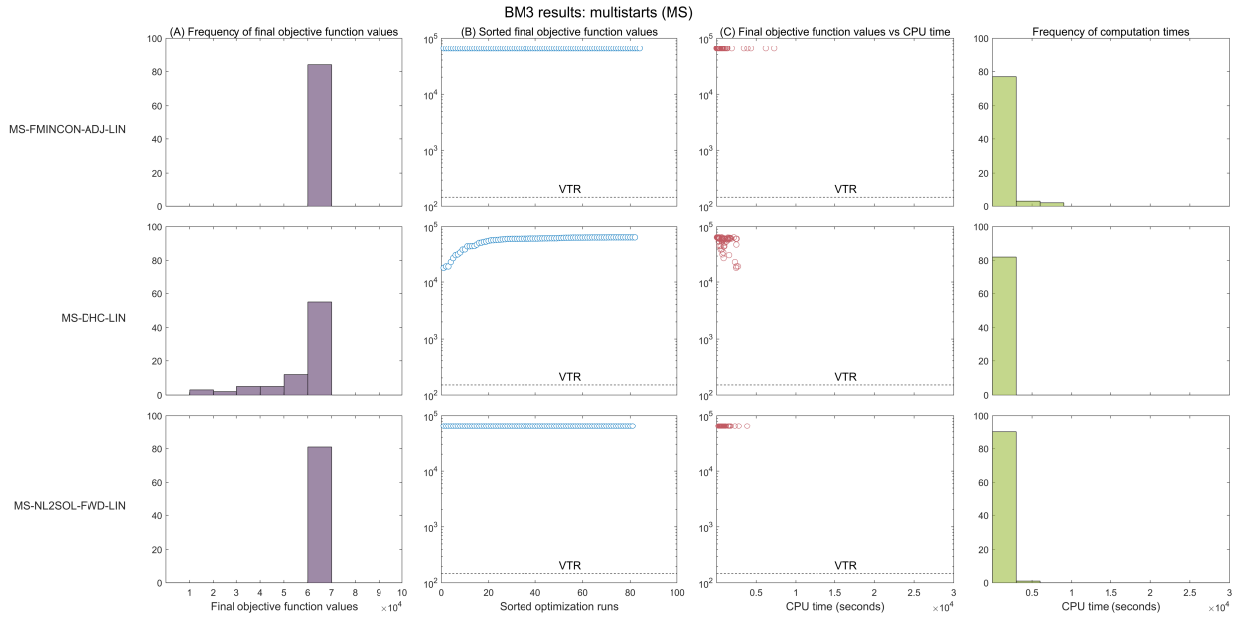

Figure S12: Results of multi-start of local searches for benchmark BM3 (LIN). The VTR used is VTR C in Table S1. Note that in the two gradient-based methods, NL2SOL and FMINCON, the use of LIN scale resulted in unsuccessful runs. However, the results greatly improved when using the LOG scale (Fig S11). The gradients for the linear and the logarithmic scale were checked and appeared to be correct.

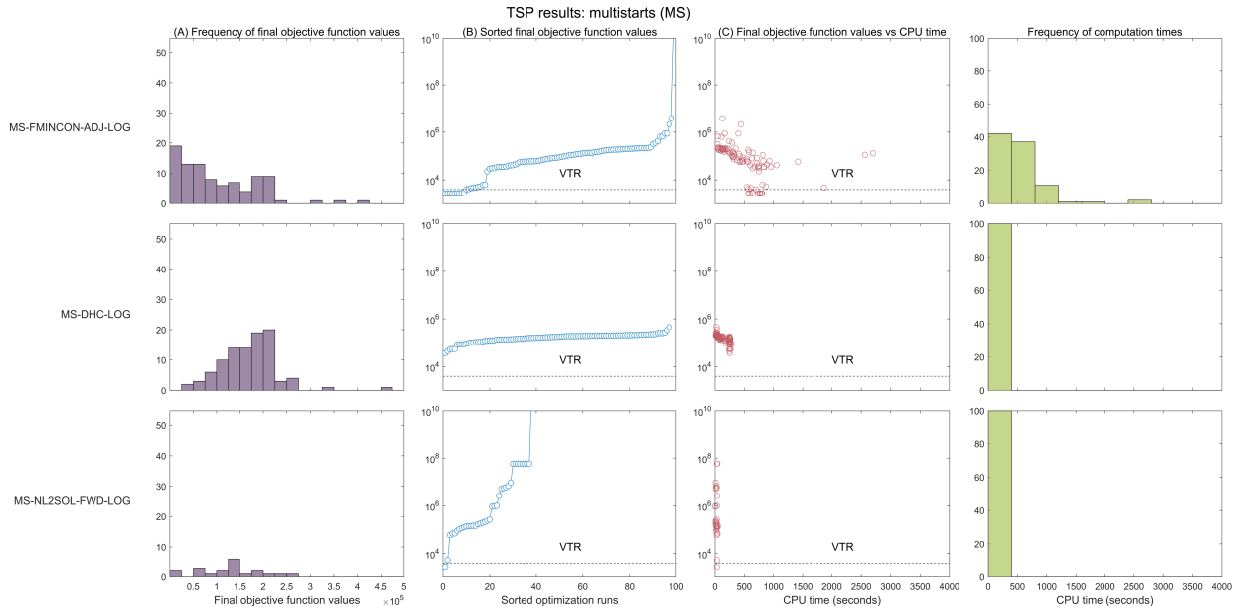

Figure S13: Results of multi-start of local searches for benchmark TSP (LOG). The VTR used is VTR C in Table S1.

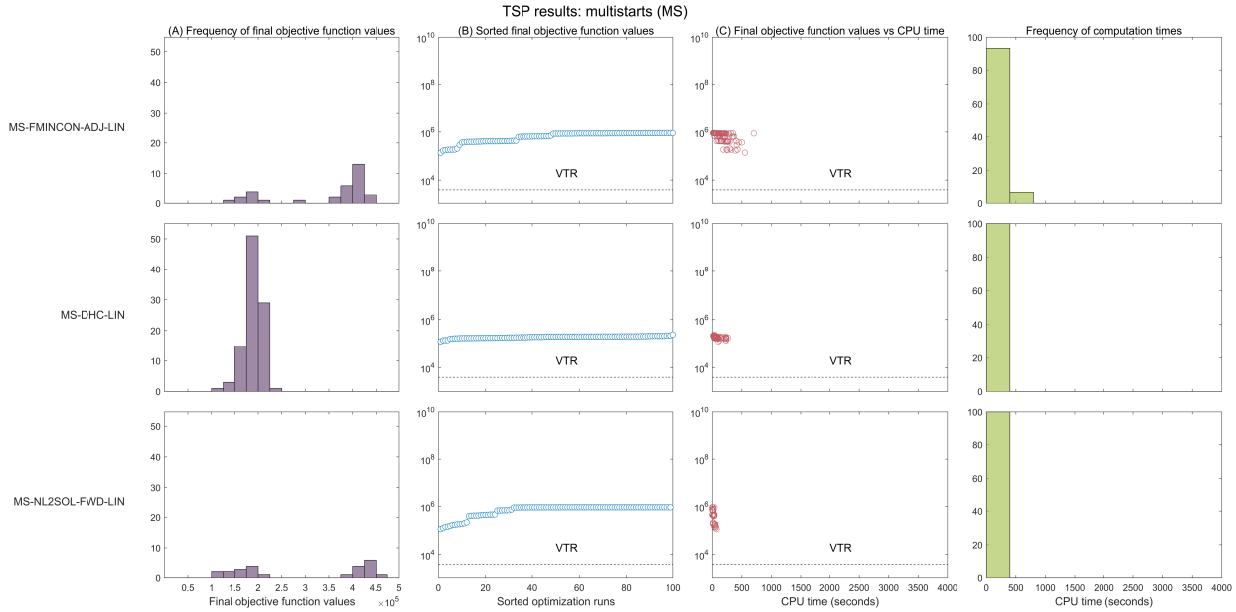

Figure S14: Results of multi-start of local searches for benchmark TSP (LIN). The VTR used is VTR C in Table S1.

3 Results: Convergence curves of eSS and MS

The following pages show the convergence curves of all methods for all benchmarks. Note that the value plotted in a convergence curve is not updated if the algorithm is in the middle of a local search, only after it finishes. This fact holds both for MS and eSS.

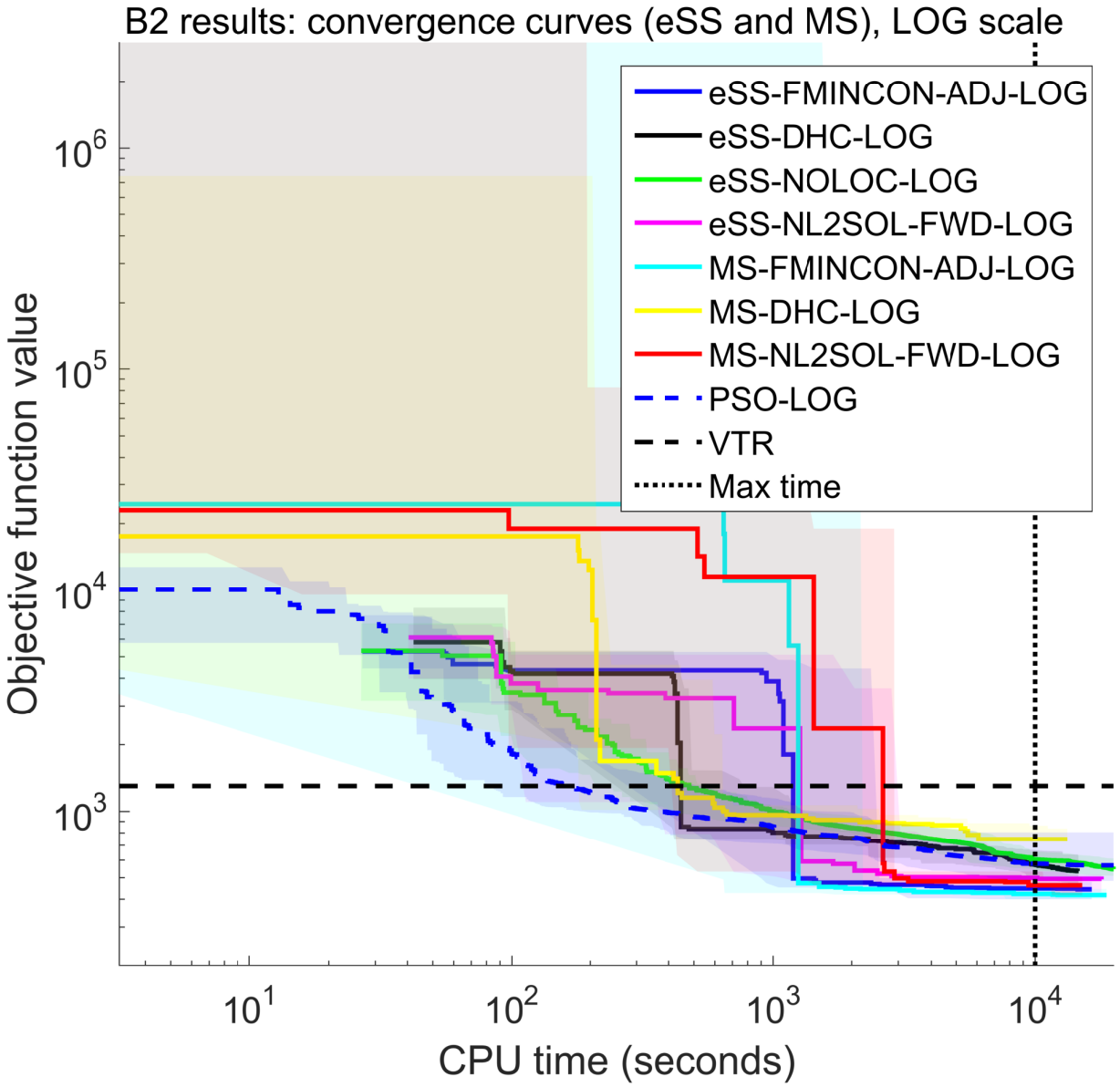

Figure S15: Convergence curves from benchmark B2 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

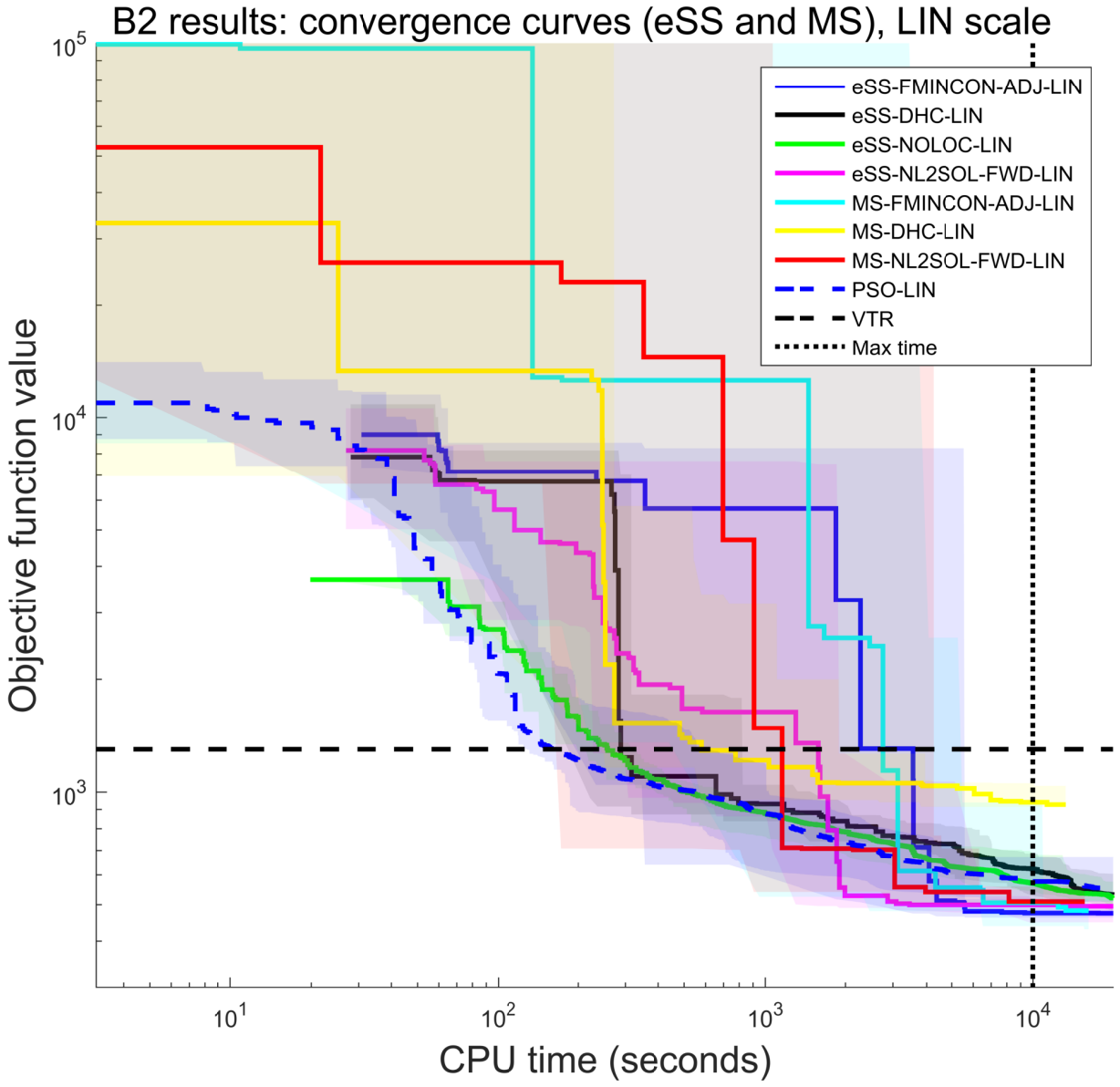

Figure S16: Convergence curves from benchmark B2 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

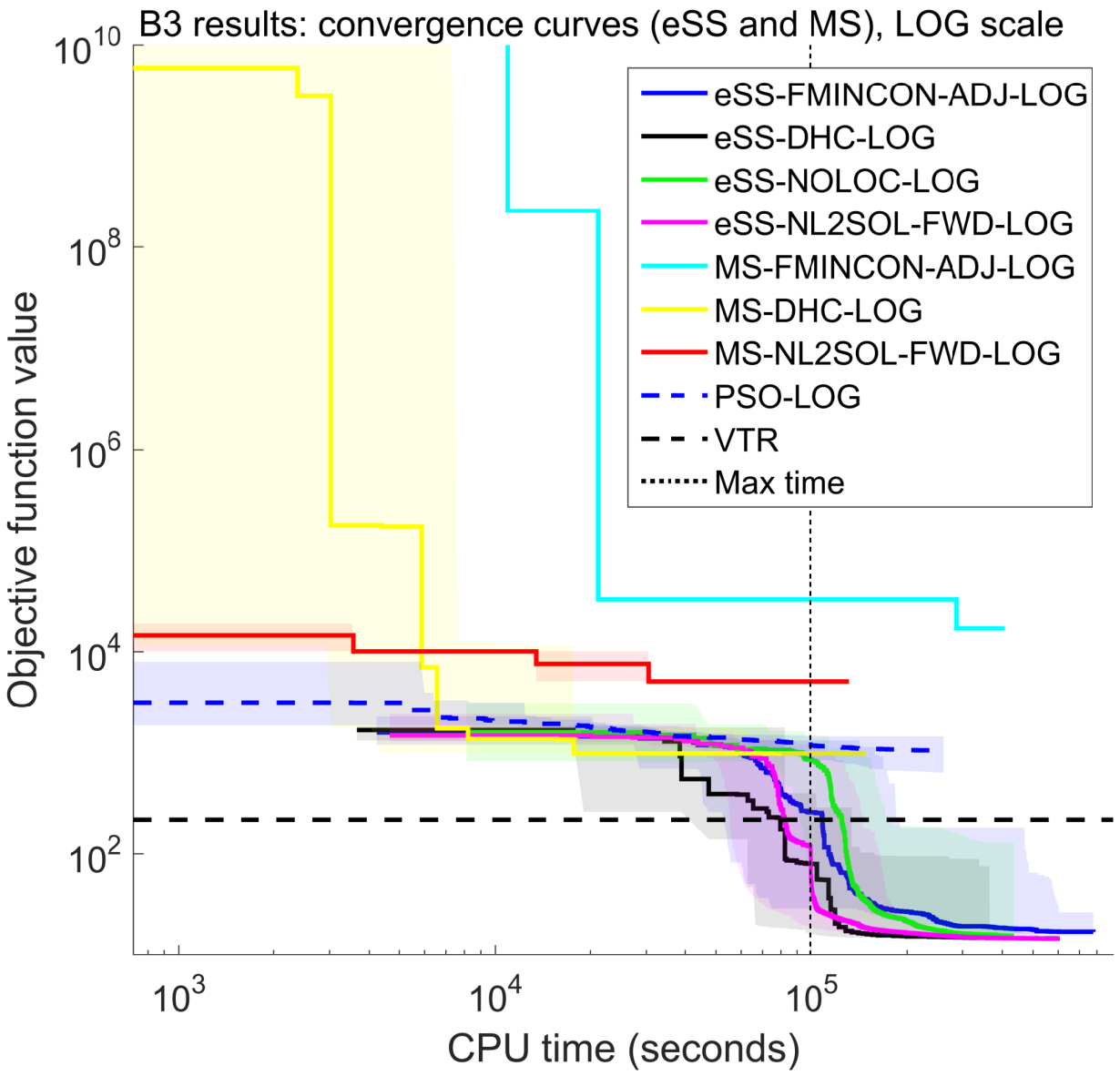

Figure S17: Convergence curves from benchmark B3 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

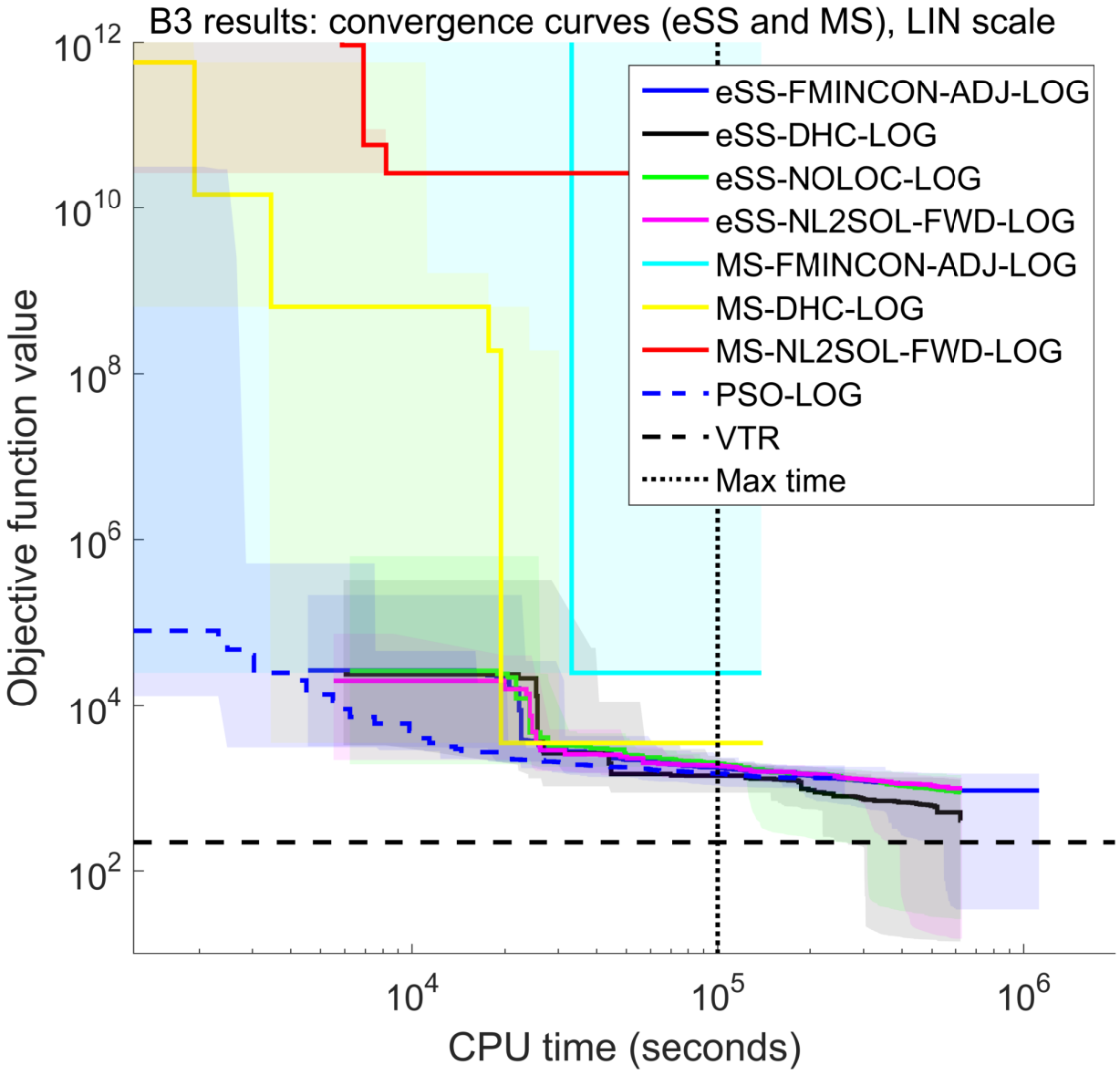

Figure S18: Convergence curves from benchmark B3 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median. Note that the MS-NL2SOL-FWD-LIN curve does not

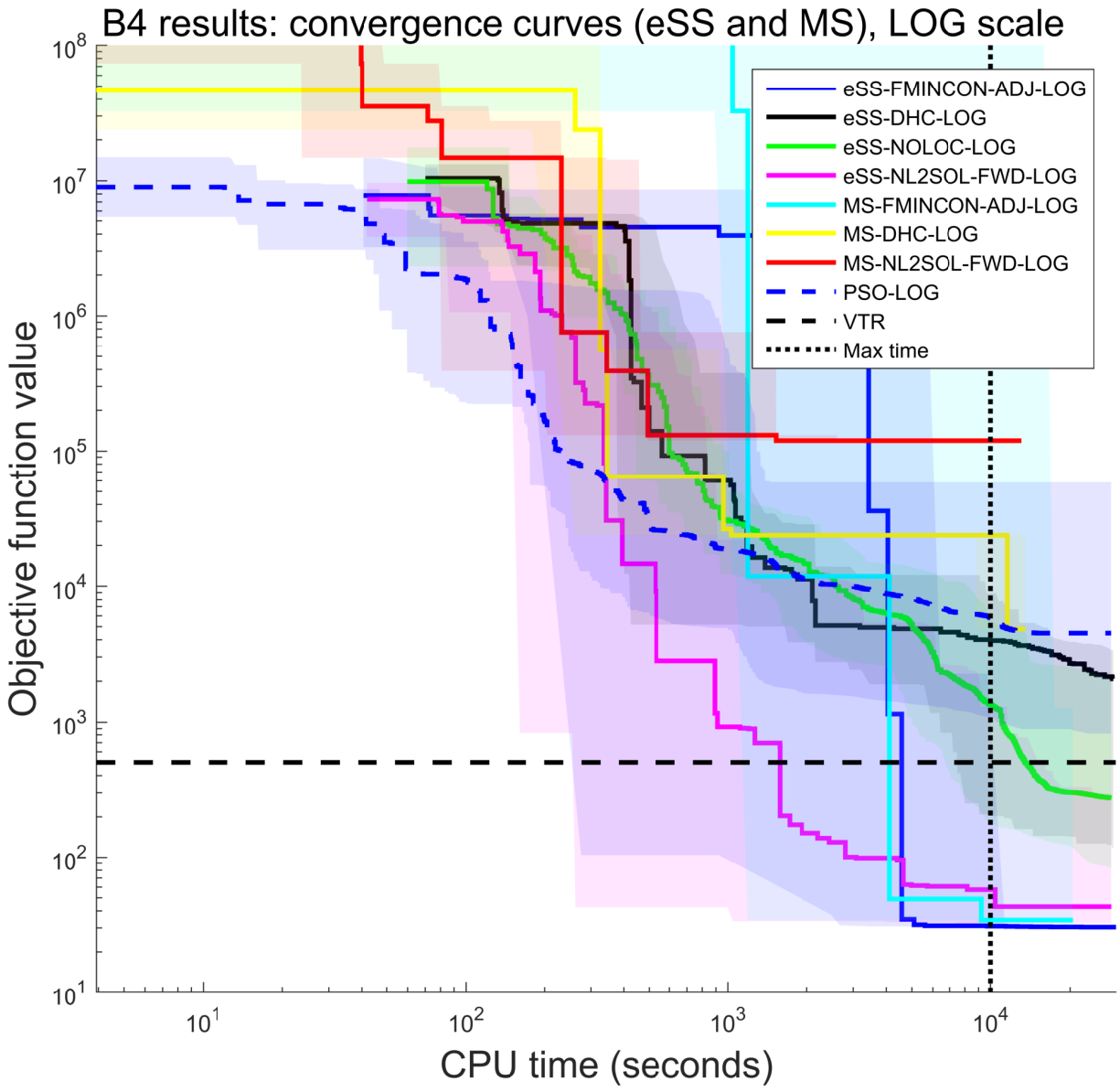

Figure S19: Convergence curves from benchmark B4 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

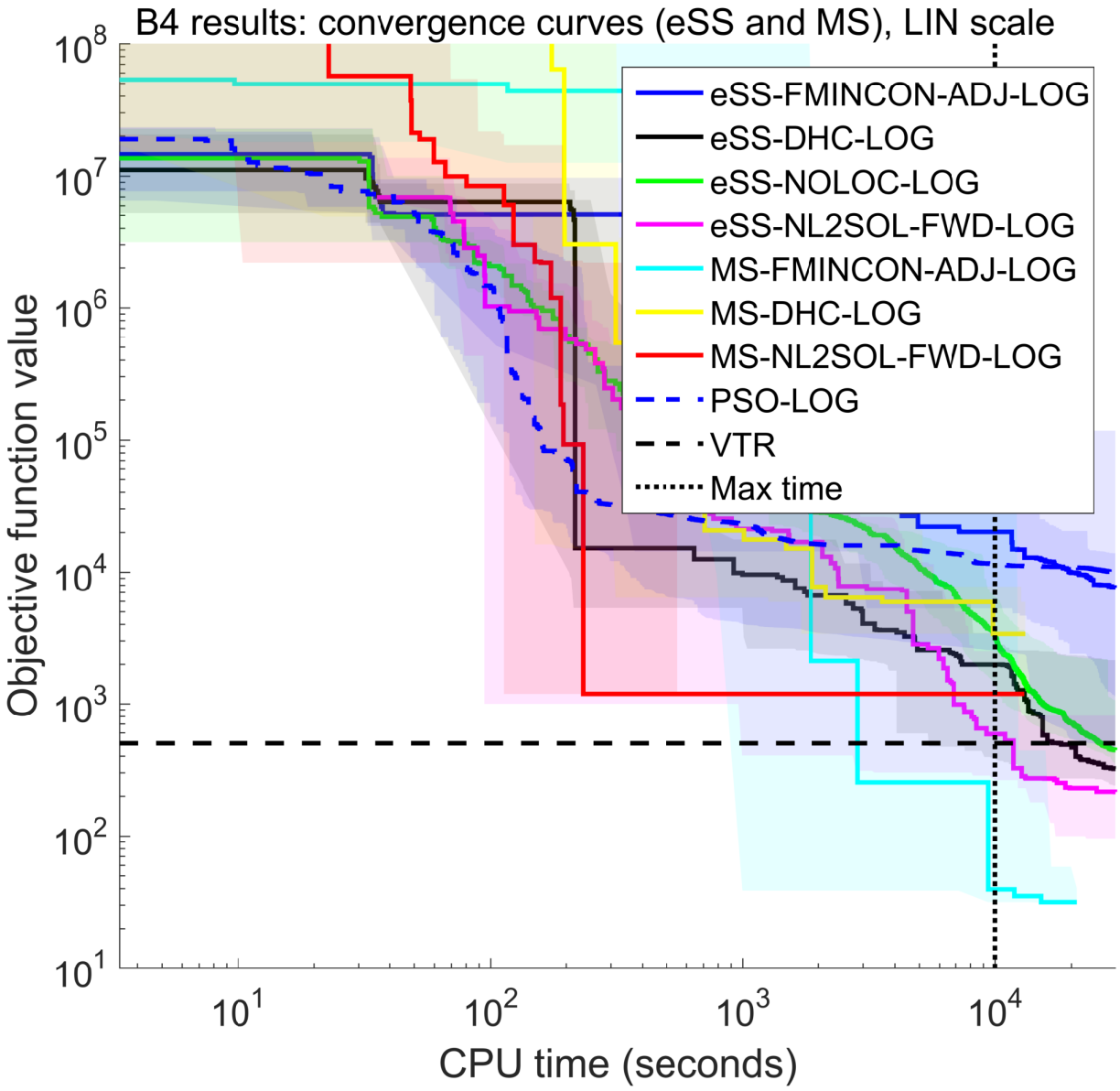

Figure S20: Convergence curves from benchmark B4 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

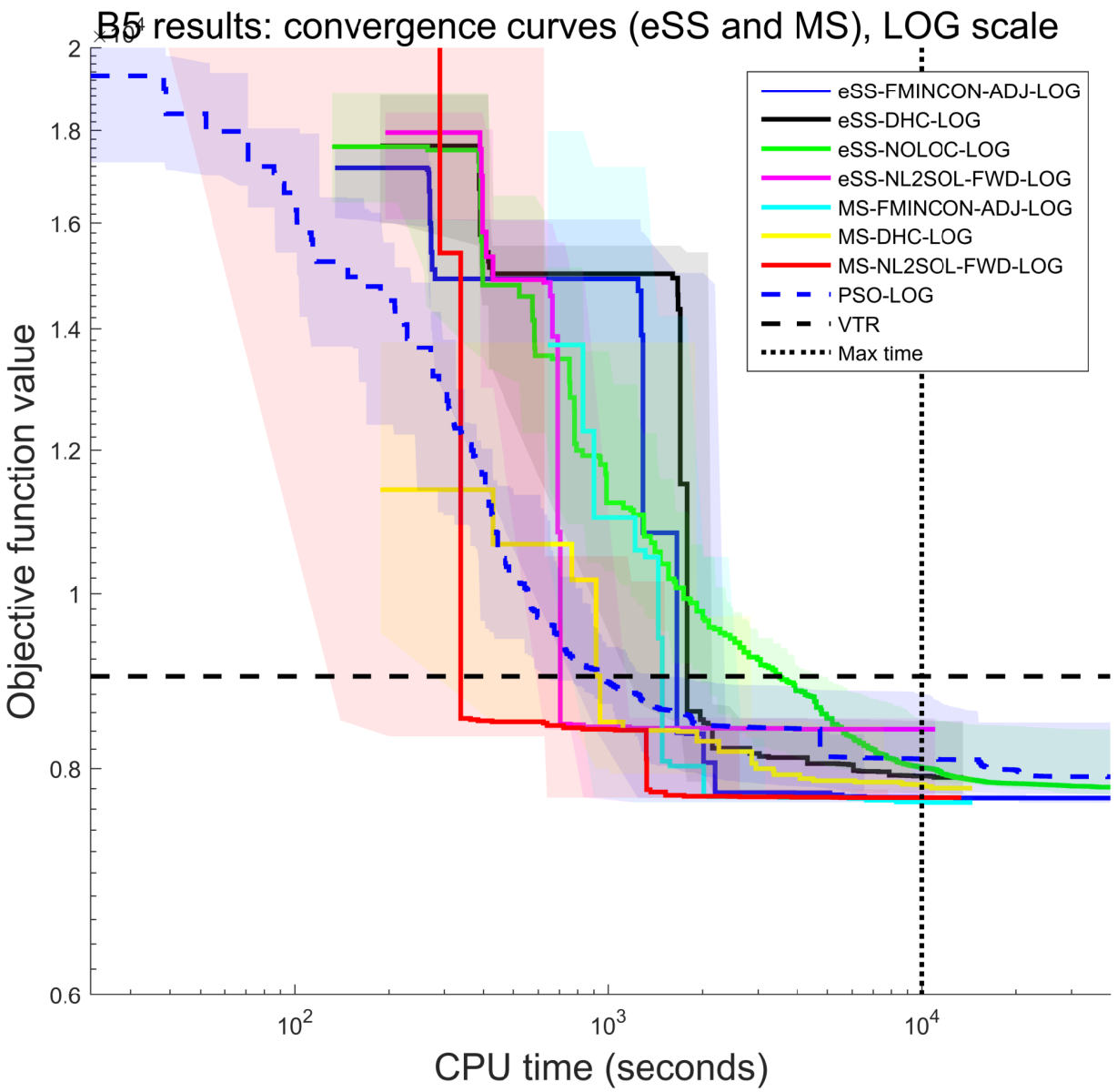

Figure S21: Convergence curves from benchmark B5 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

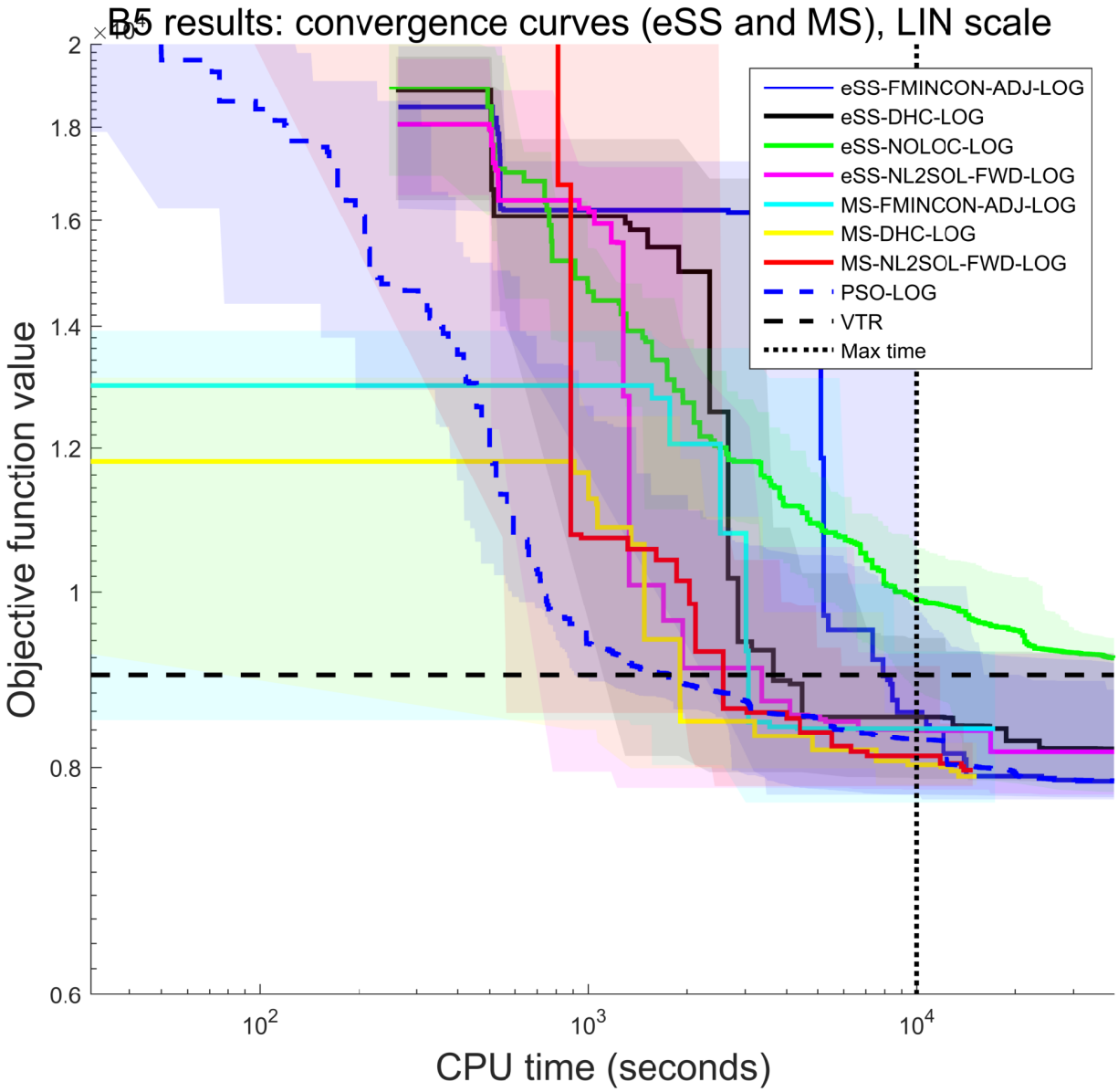

Figure S22: Convergence curves from benchmark B5 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

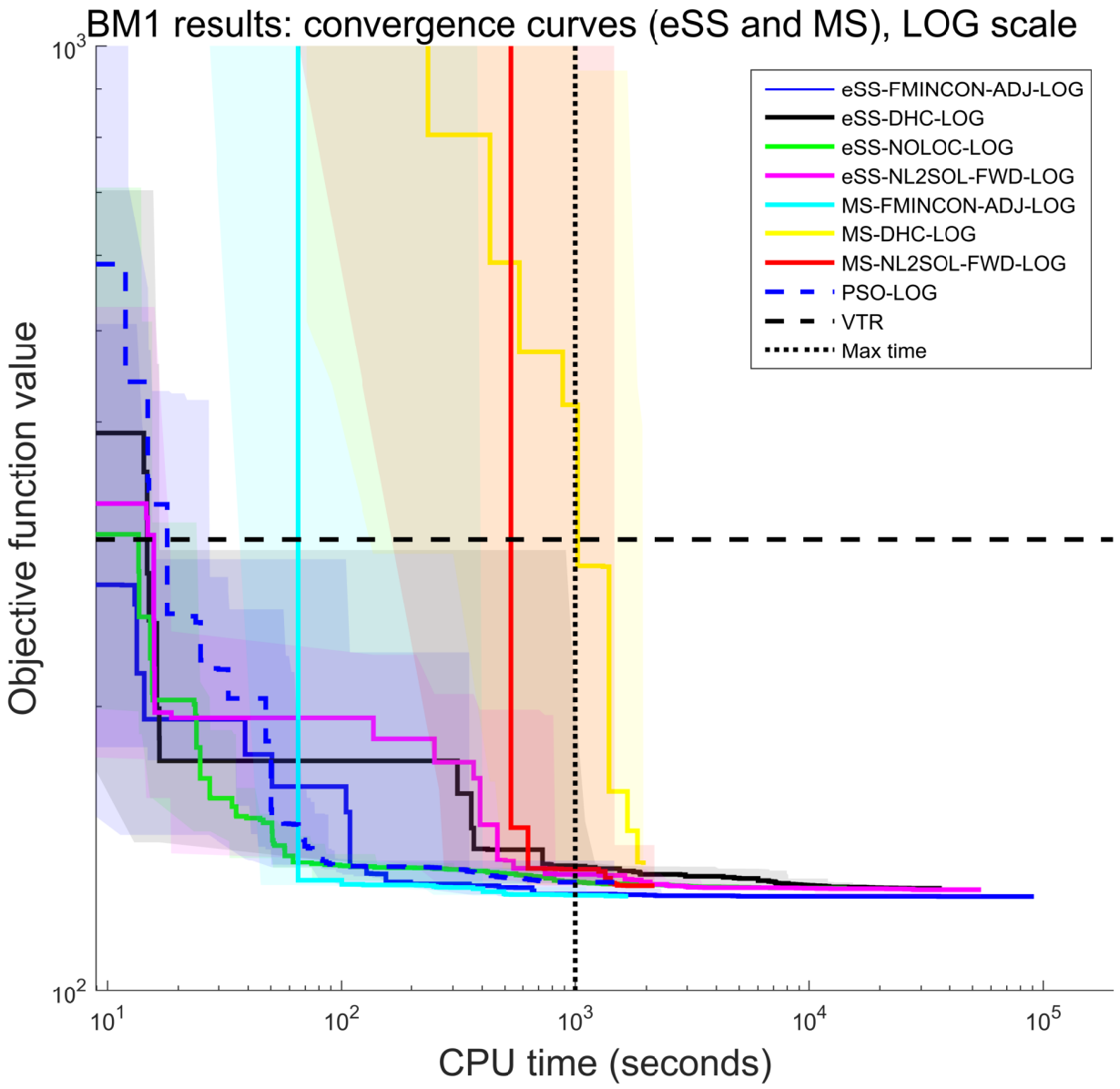

Figure S23: Convergence curves from benchmark BM1 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

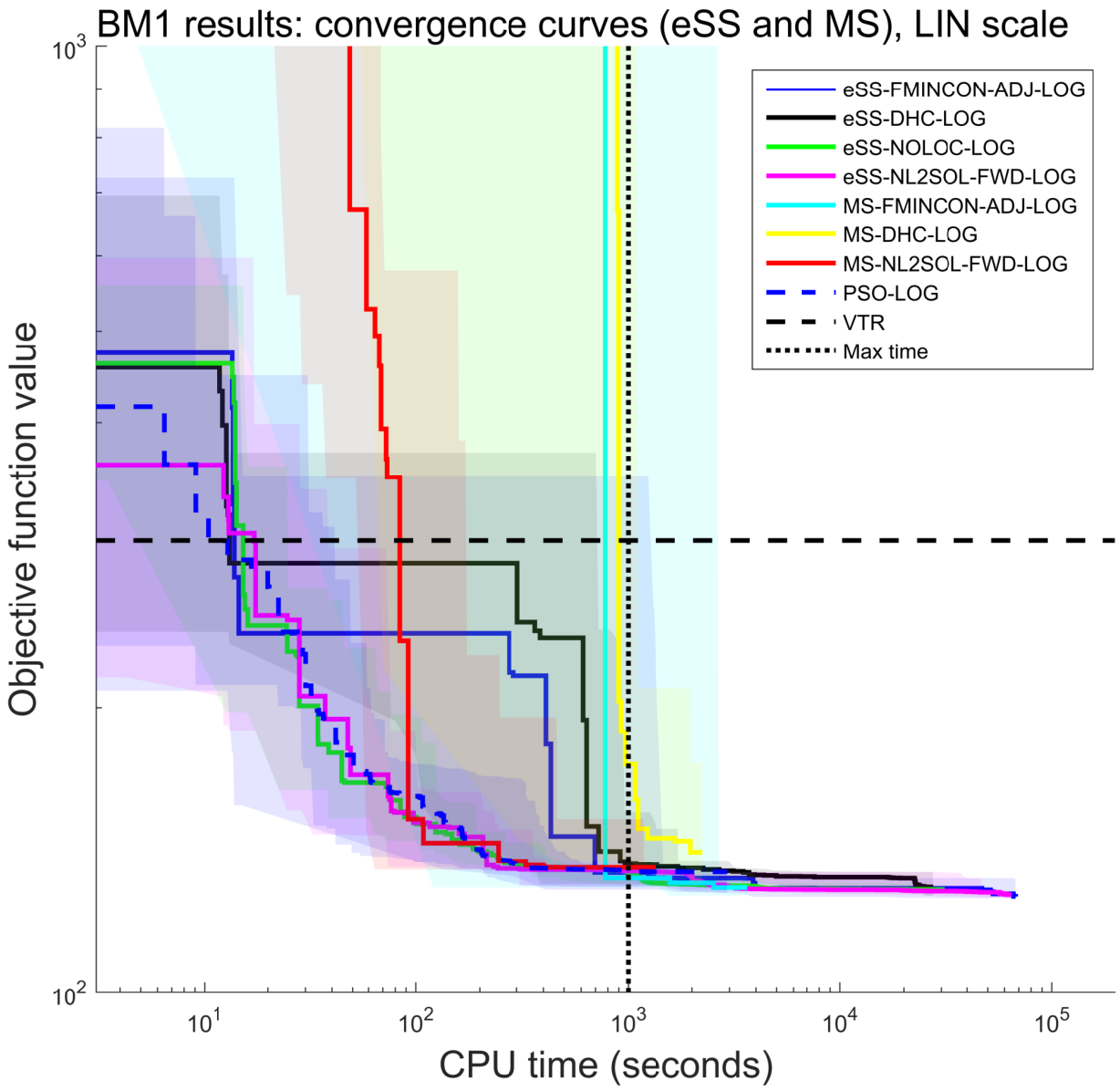

Figure S24: Convergence curves from benchmark BM1 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

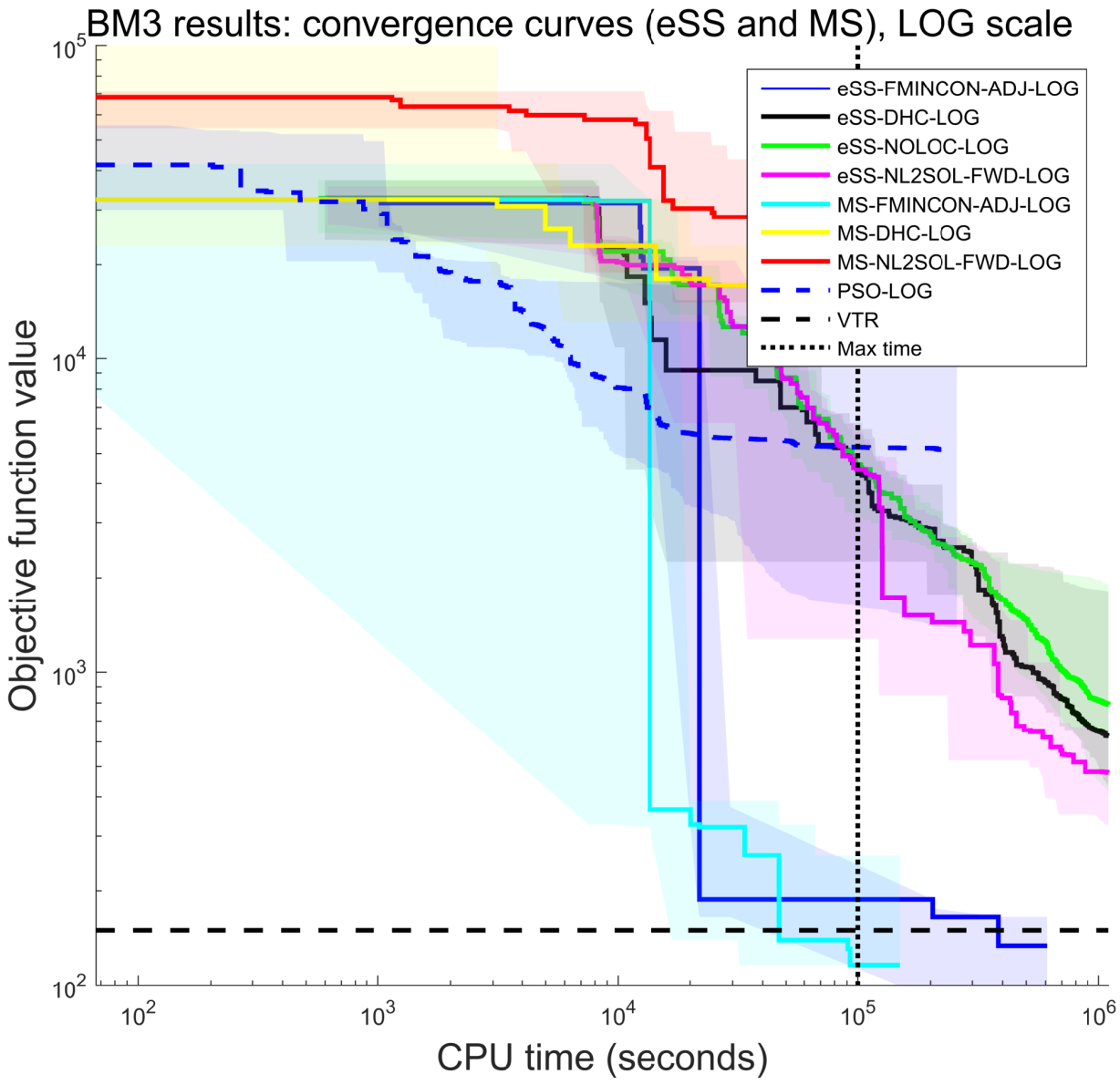

Figure S25: Convergence curves from benchmark BM3 (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

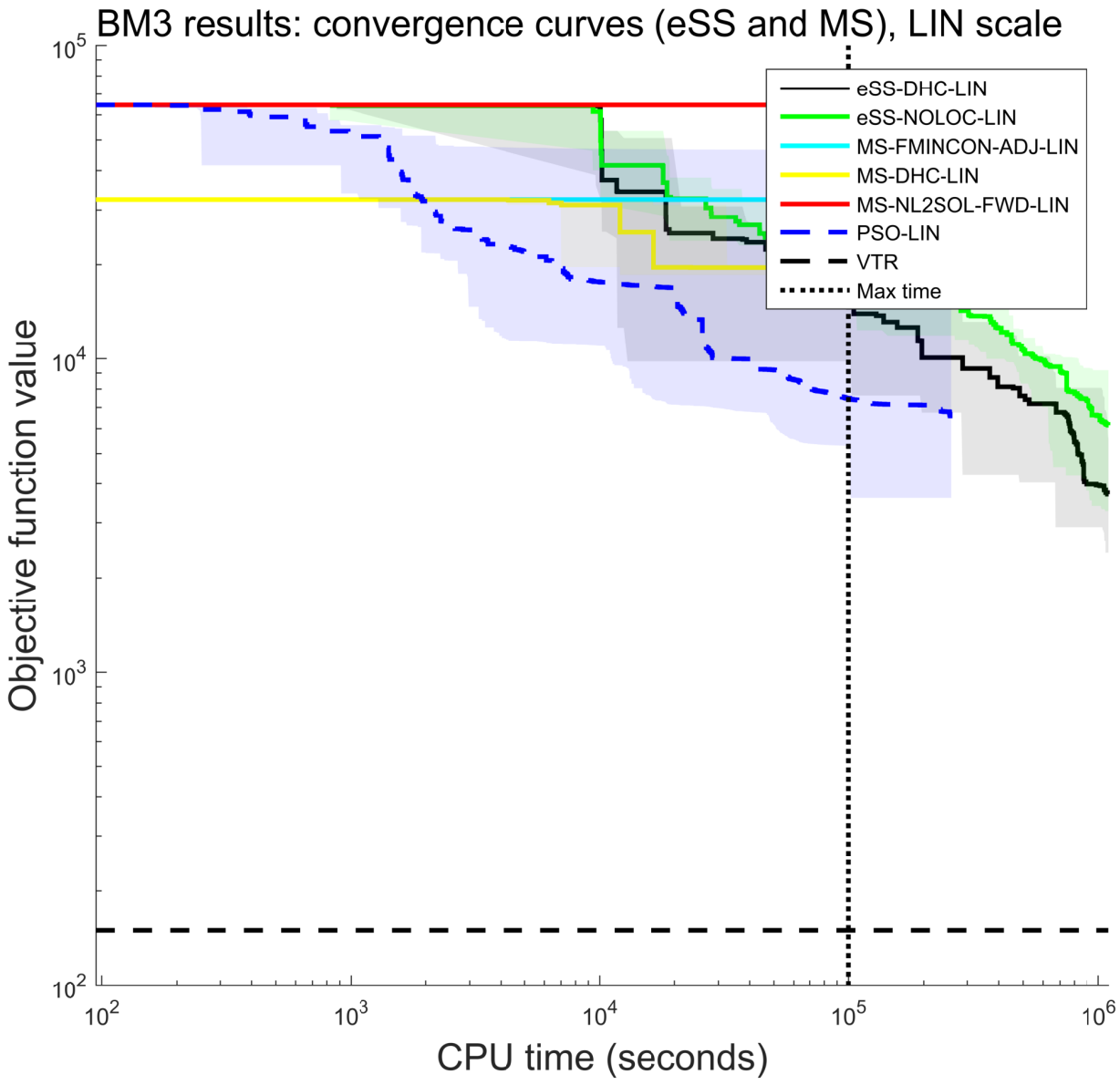

Figure S26: Convergence curves from benchmark BM3 (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

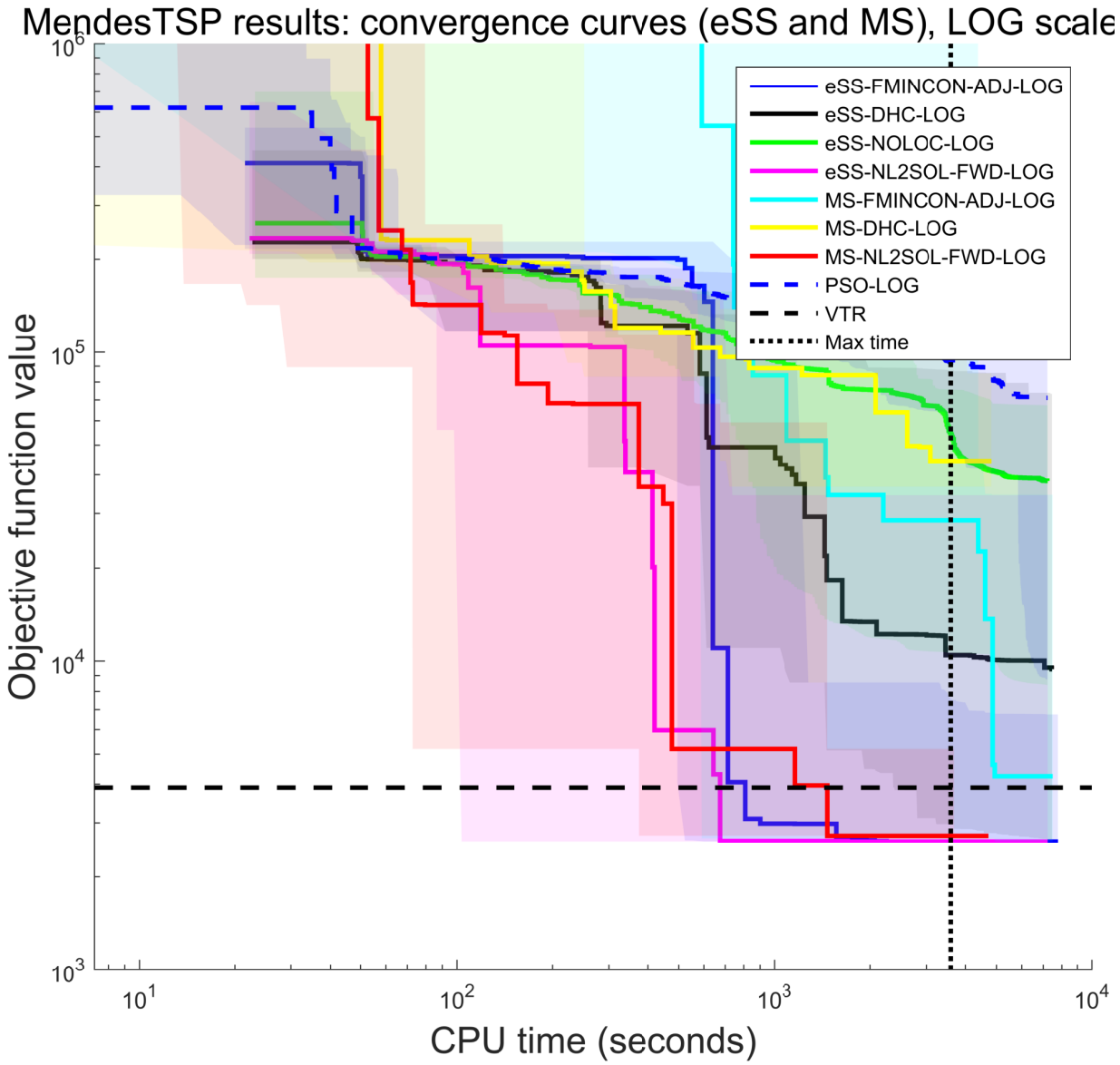

Figure S27: Convergence curves from benchmark TSP (LOG). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

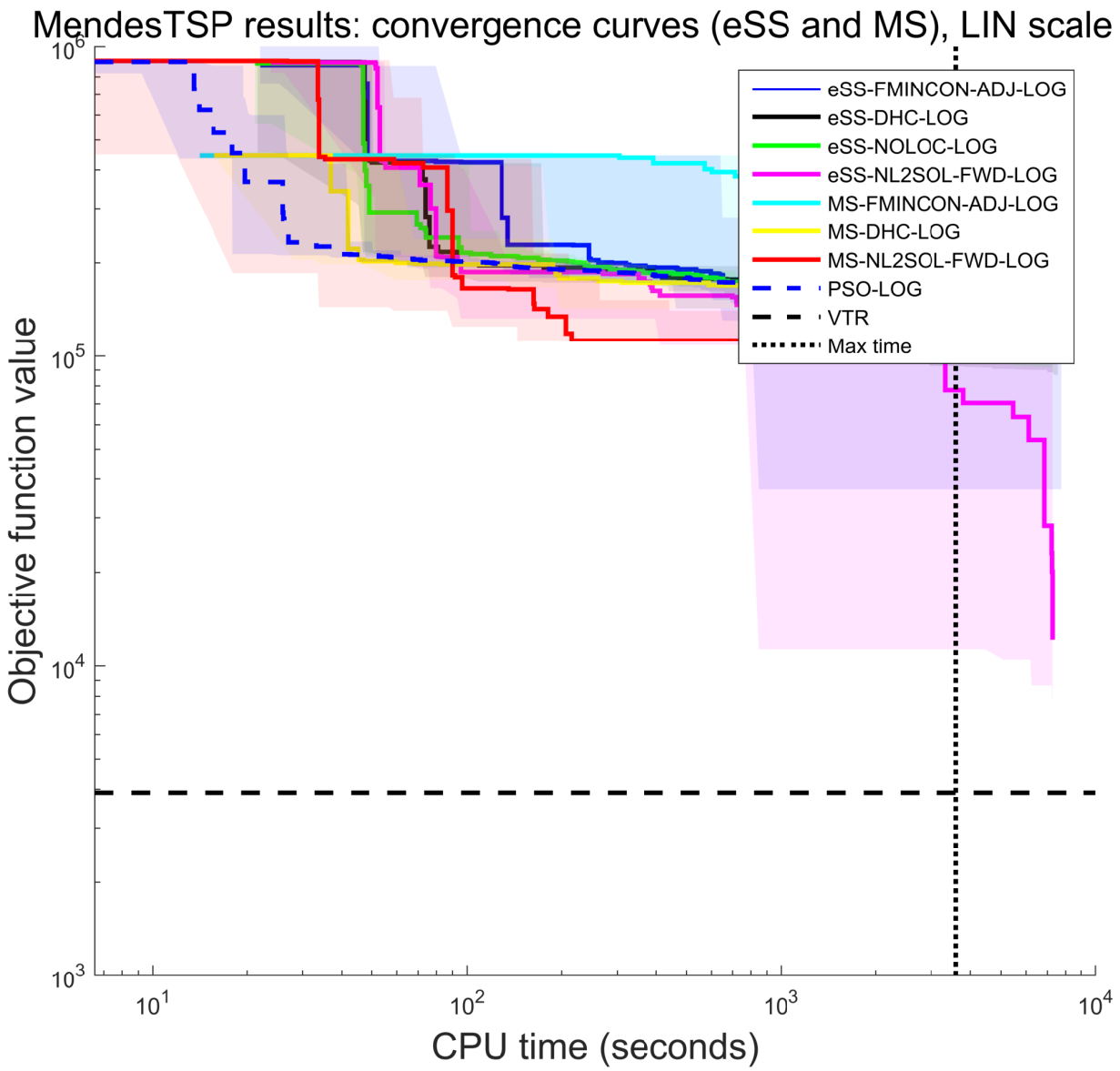

Figure S28: Convergence curves from benchmark TSP (LIN). The plot displays VTR C and MAXT A; their values are listed on Table S1. Shaded areas show the range of all runs, while solid lines represent their median.

4 Results: Summary tables and figures

4.1 Success vs. time

4.1.1 VTR A, MAXT A

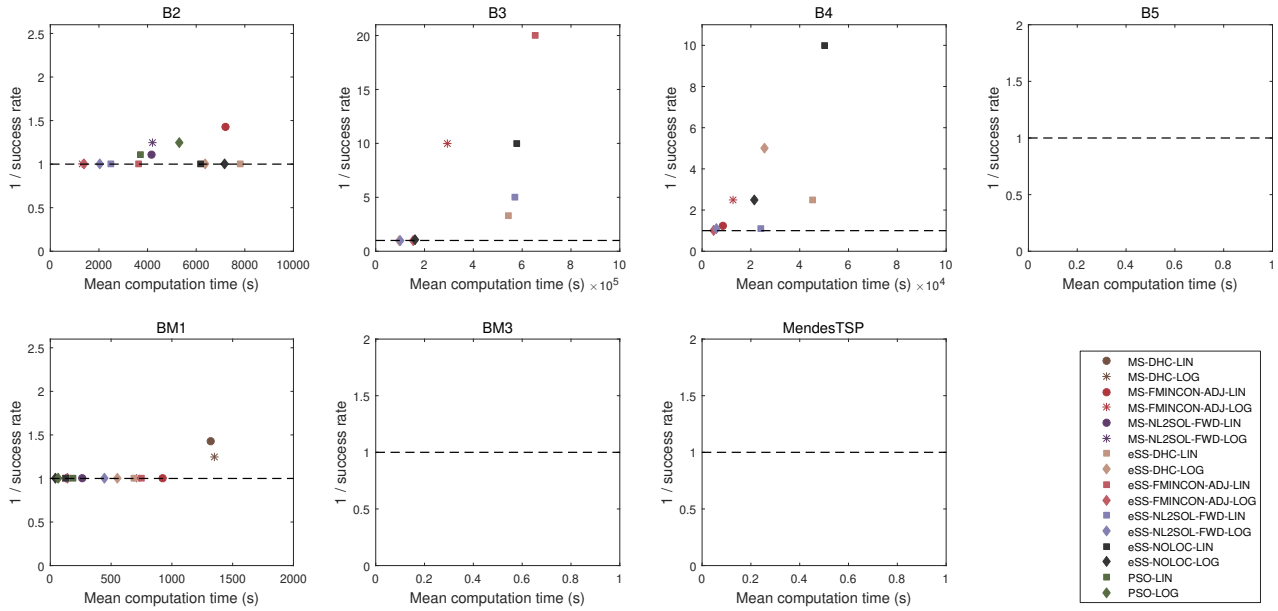

Figure S29: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR A and MAXT A from Table S1.

4.1.2 VTR A, MAXT B

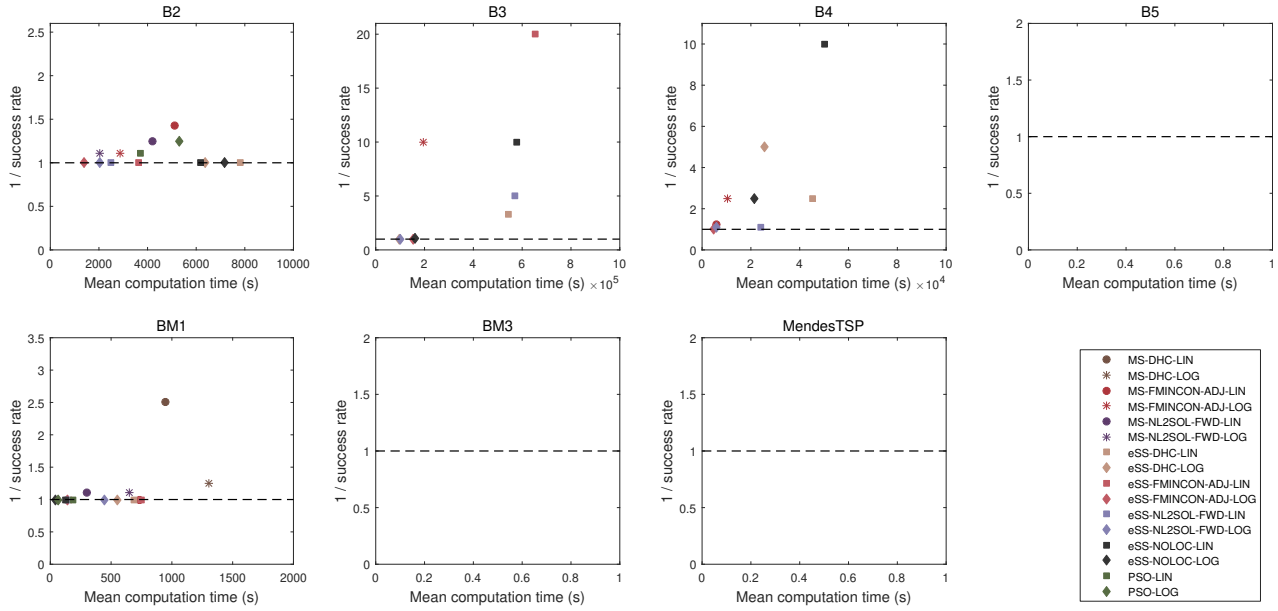

Figure S30: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR A and MAXT B from Table S1.

4.1.3 VTR B, MAXT A

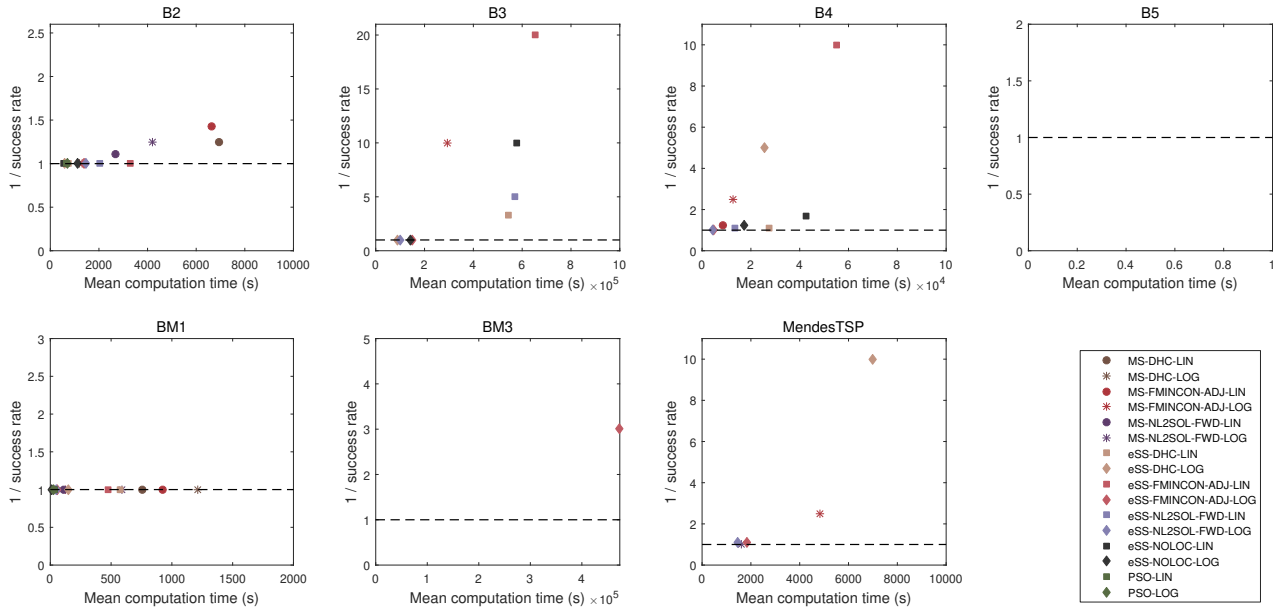

Figure S31: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR B and MAXT A from Table S1.

4.1.4 VTR B, MAXT B

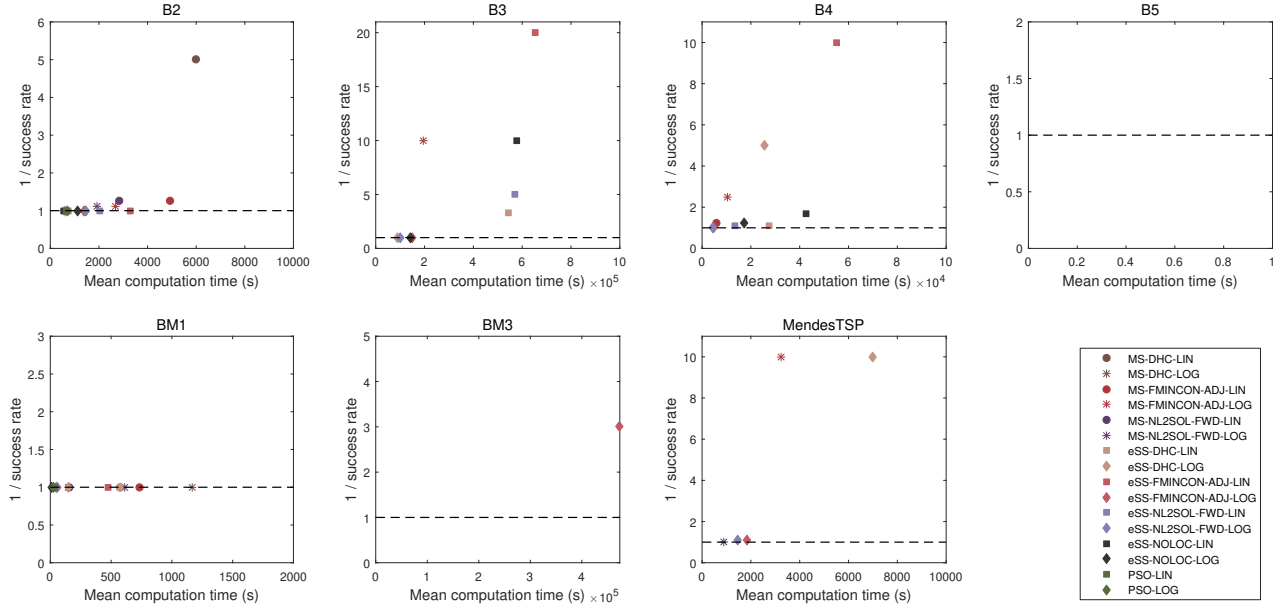

Figure S32: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR B and MAXT B from Table S1.

4.1.5 VTR C, MAXT A

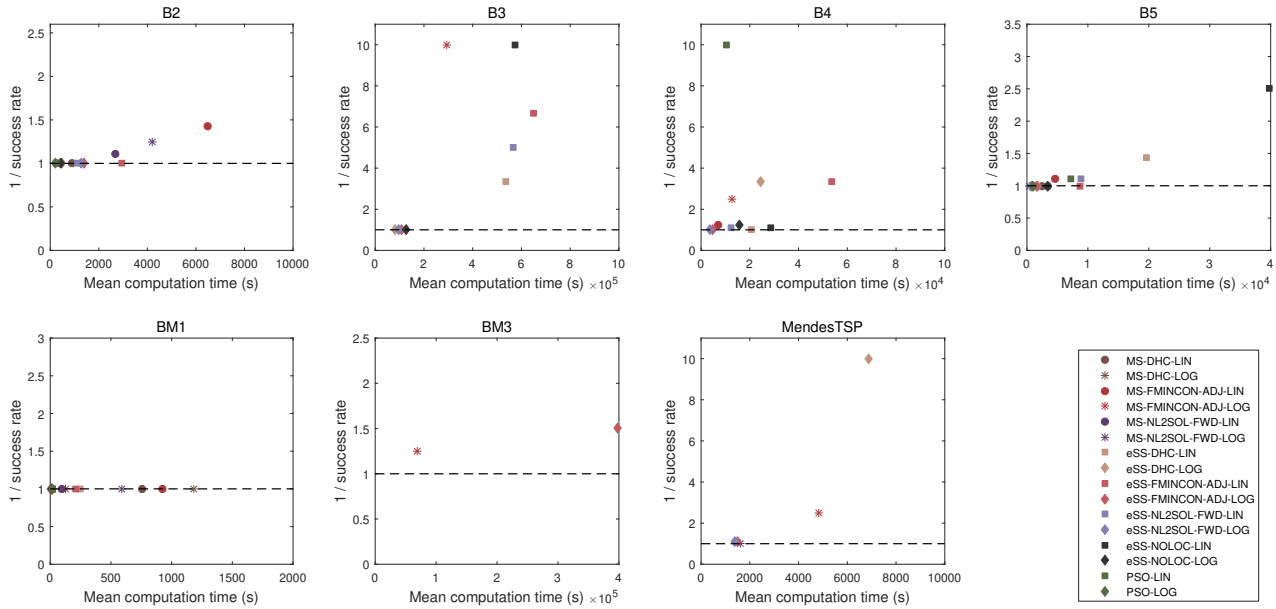

Figure S33: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR C and MAXT A from Table S1.

4.1.6 VTR C, MAXT B

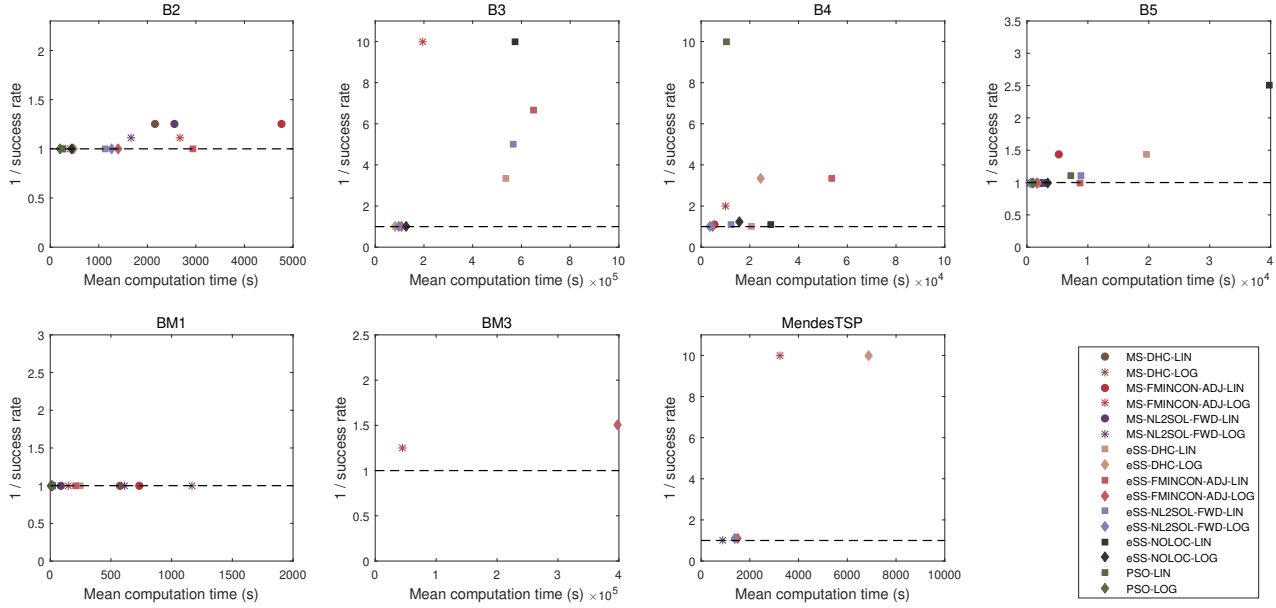

Figure S34: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR C and MAXT B from Table S1.

4.1.7 VTR D, MAXT A

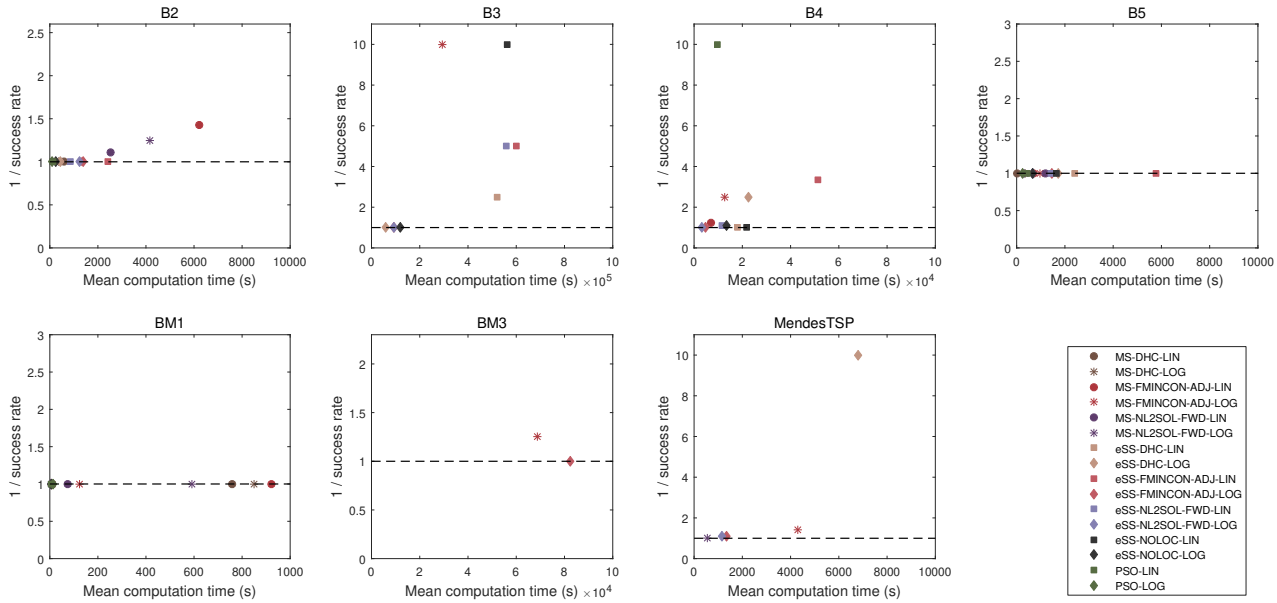

Figure S35: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR D and MAXT A from Table S1.

4.1.8 VTR D, MAXT B

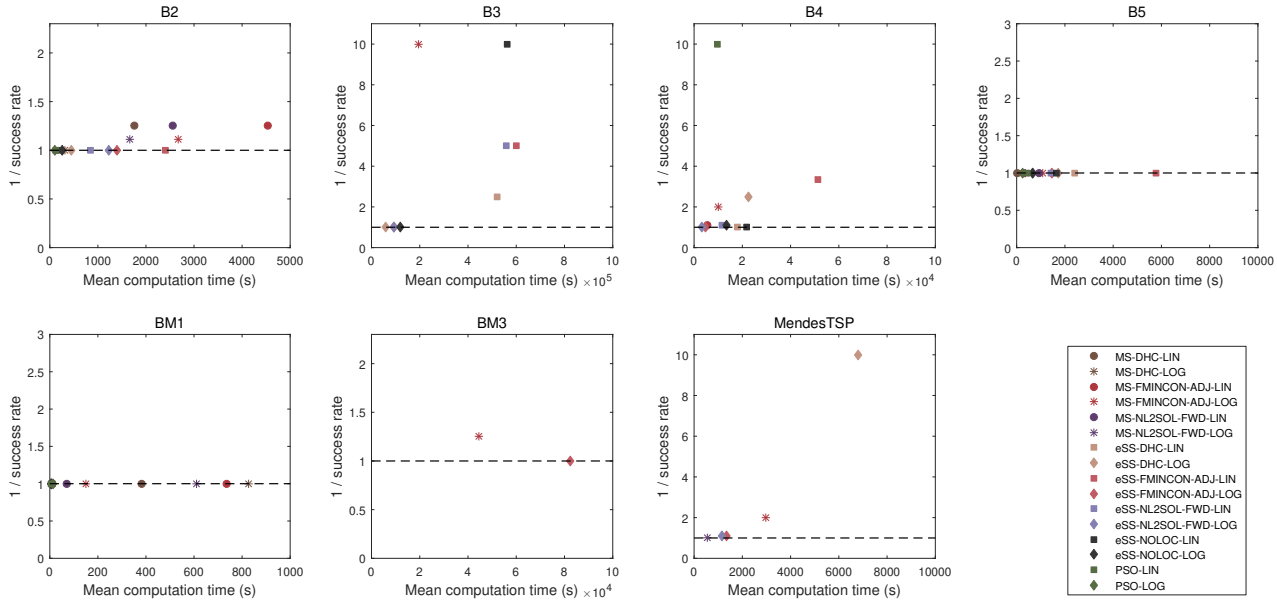

Figure S36: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR D and MAXT B from Table S1.

4.1.9 VTR E, MAXT A

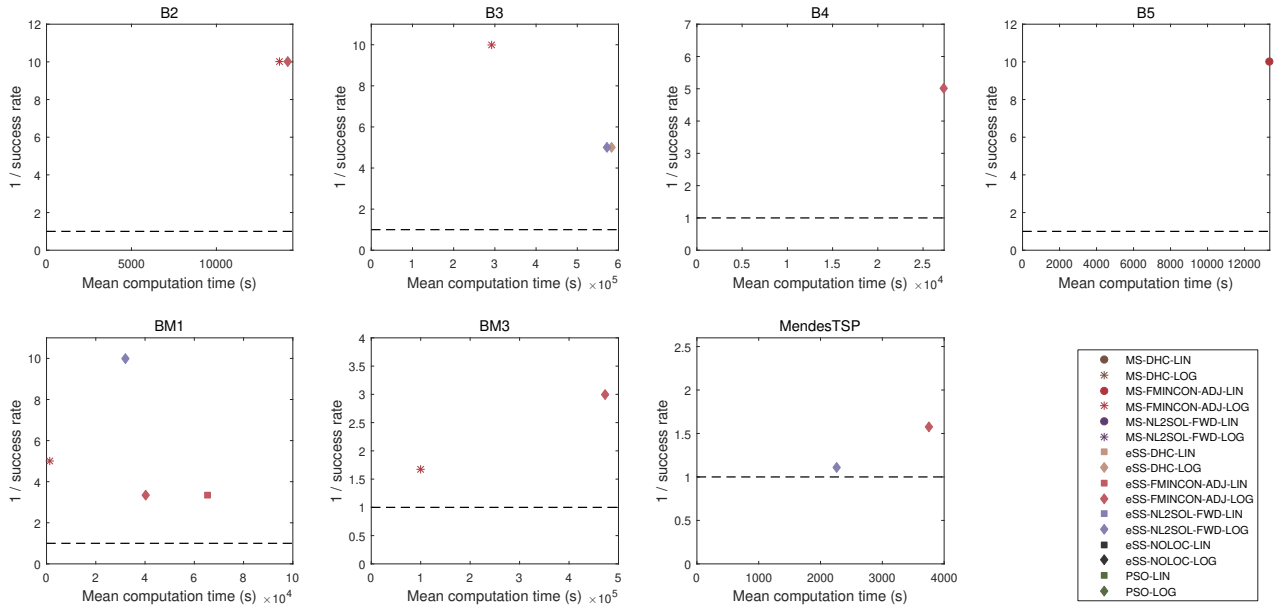

Figure S37: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR E and MAXT A from Table S1.

4.1.10 VTR E, MAXT B

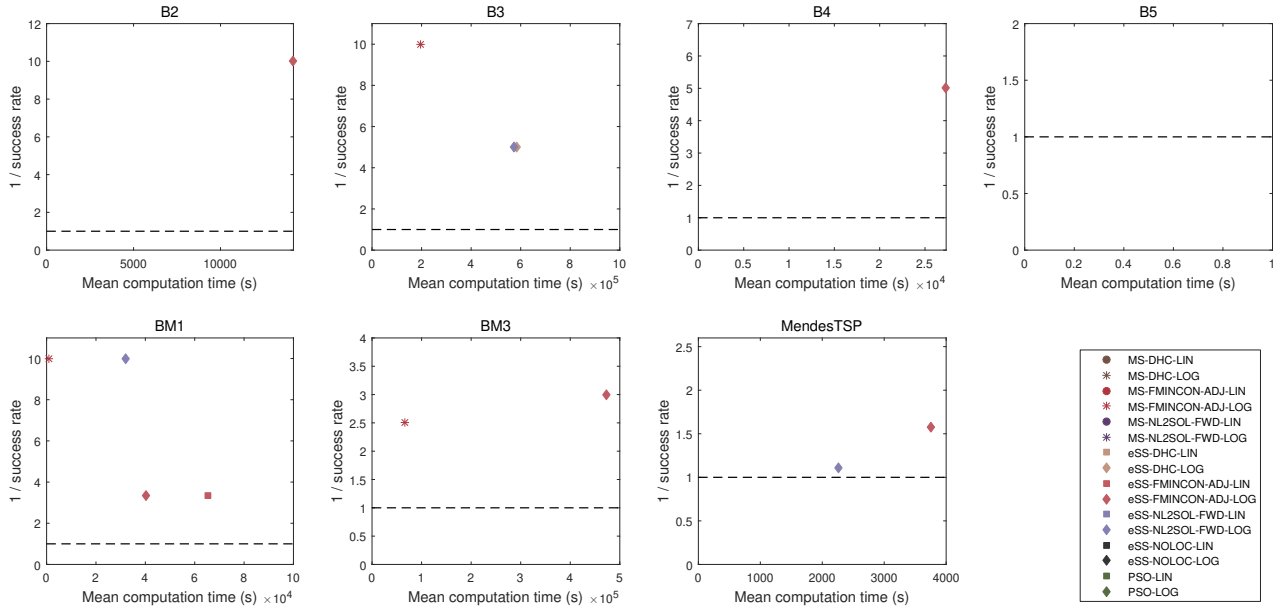

Figure S38: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR E and MAXT B from Table S1.

4.1.11 VTR F, MAXT A

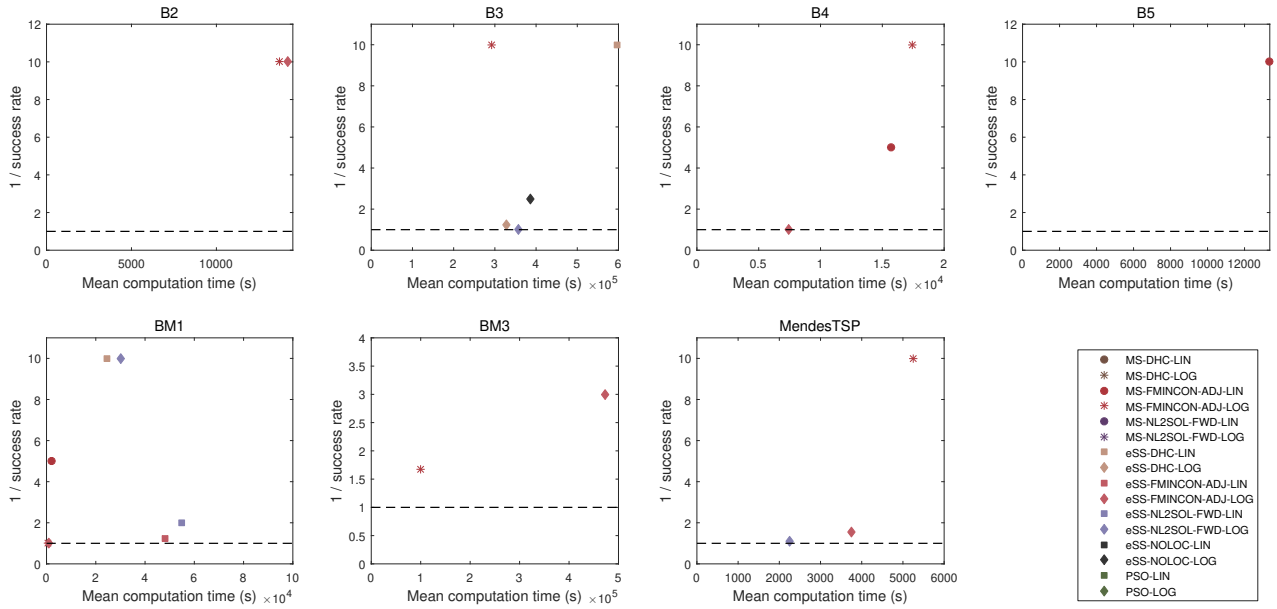

Figure S39: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR F and MAXT A from Table S1.

4.1.12 VTR F, MAXT B

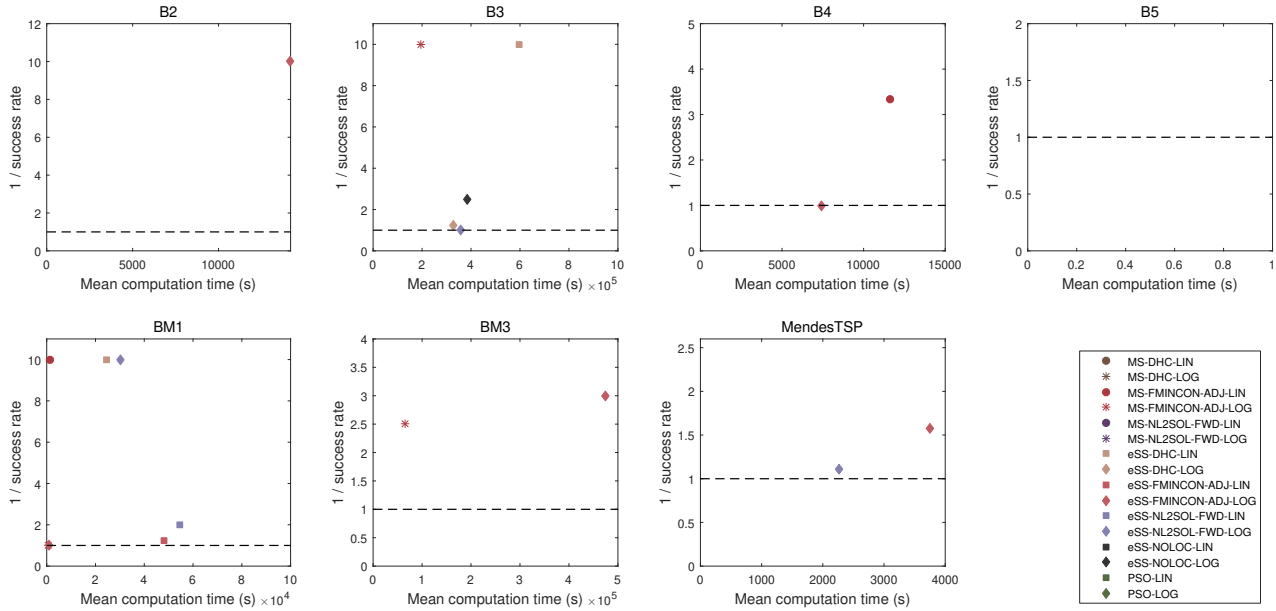

Figure S40: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR F and MAXT B from Table S1.

4.1.13 VTR G, MAXT A

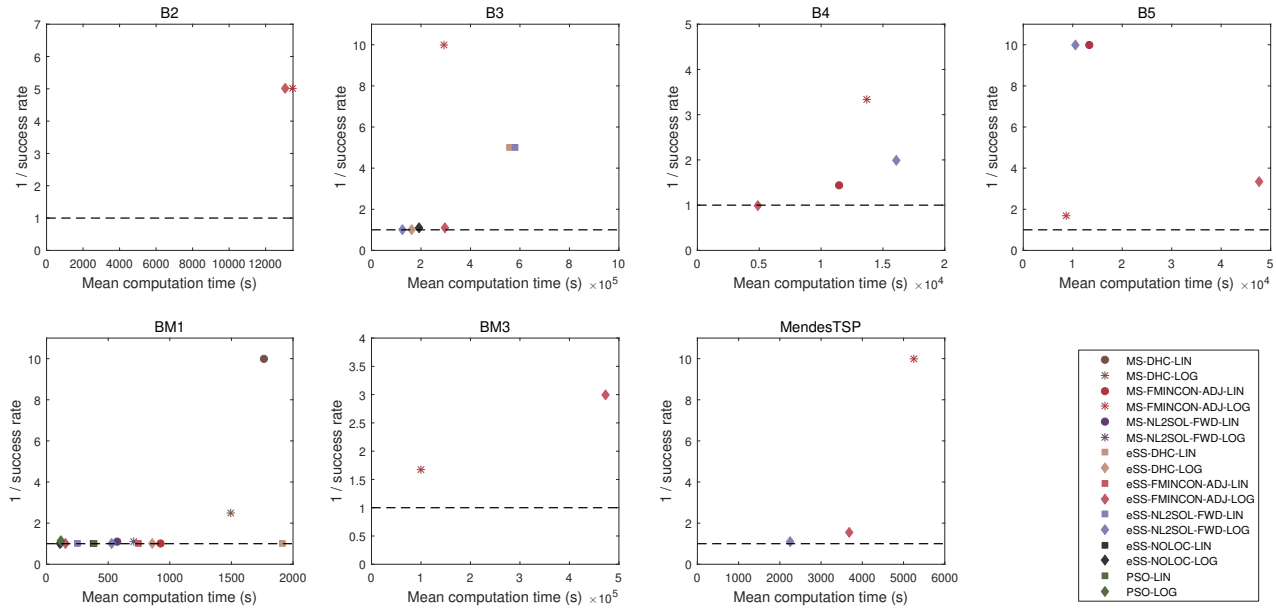

Figure S41: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR G and MAXT A from Table S1.

4.1.14 VTR G, MAXT B

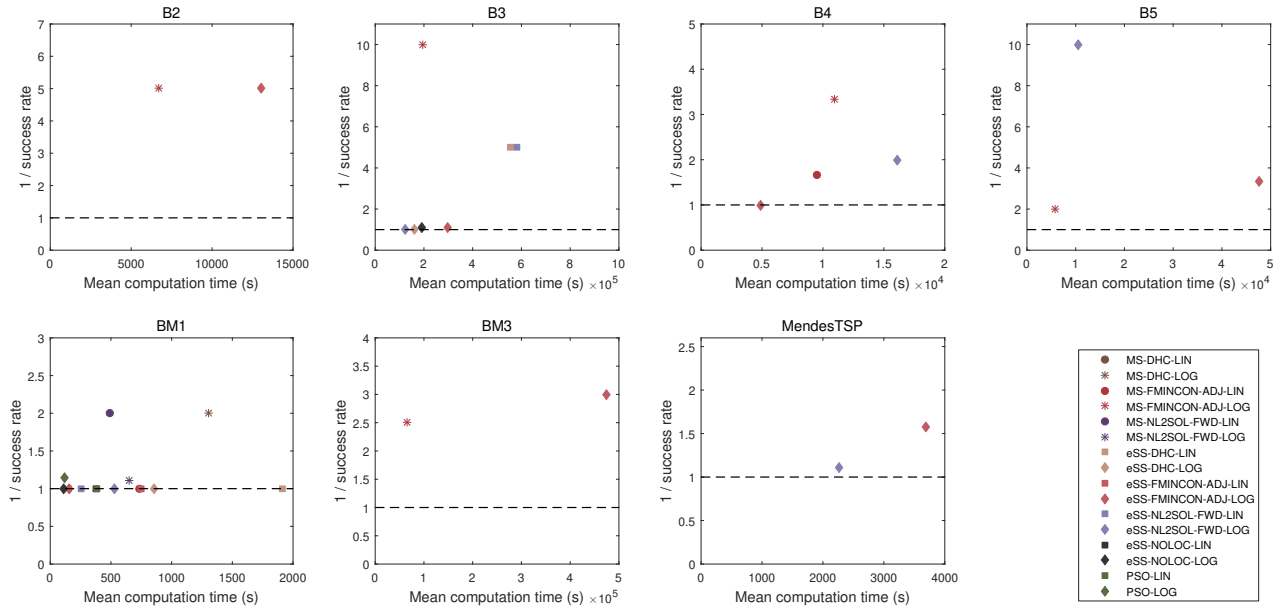

Figure S42: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR G and MAXT B from Table S1.

4.1.15 VTR H, MAXT A

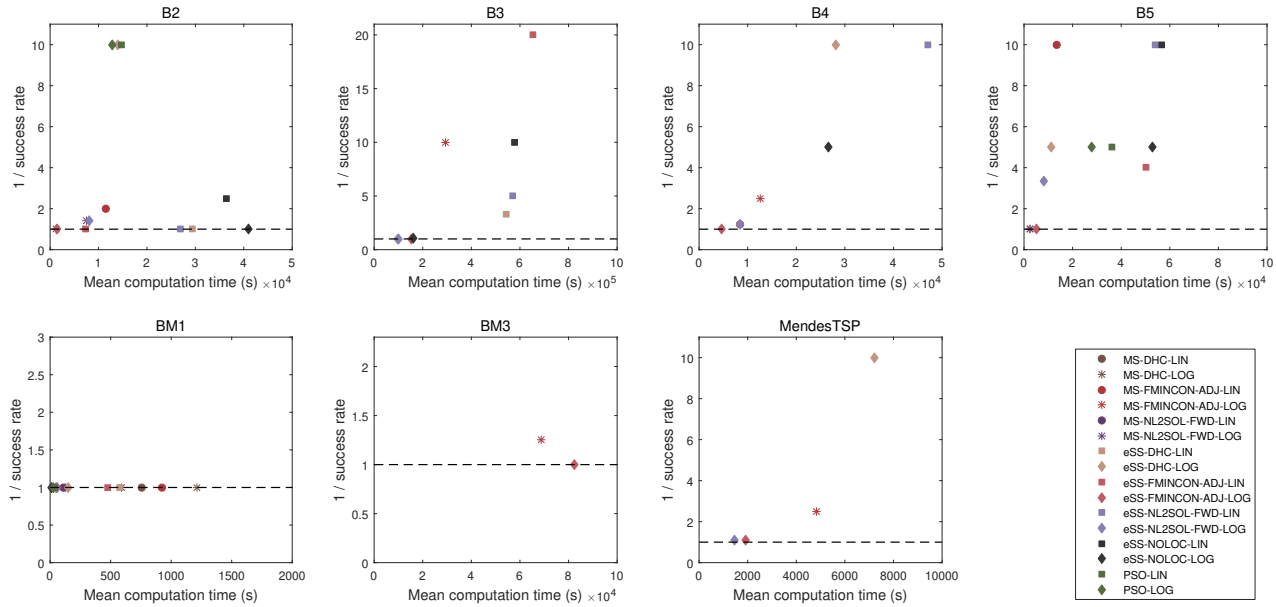

Figure S43: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR H and MAXT A from Table S1.

4.1.16 VTR H, MAXT B

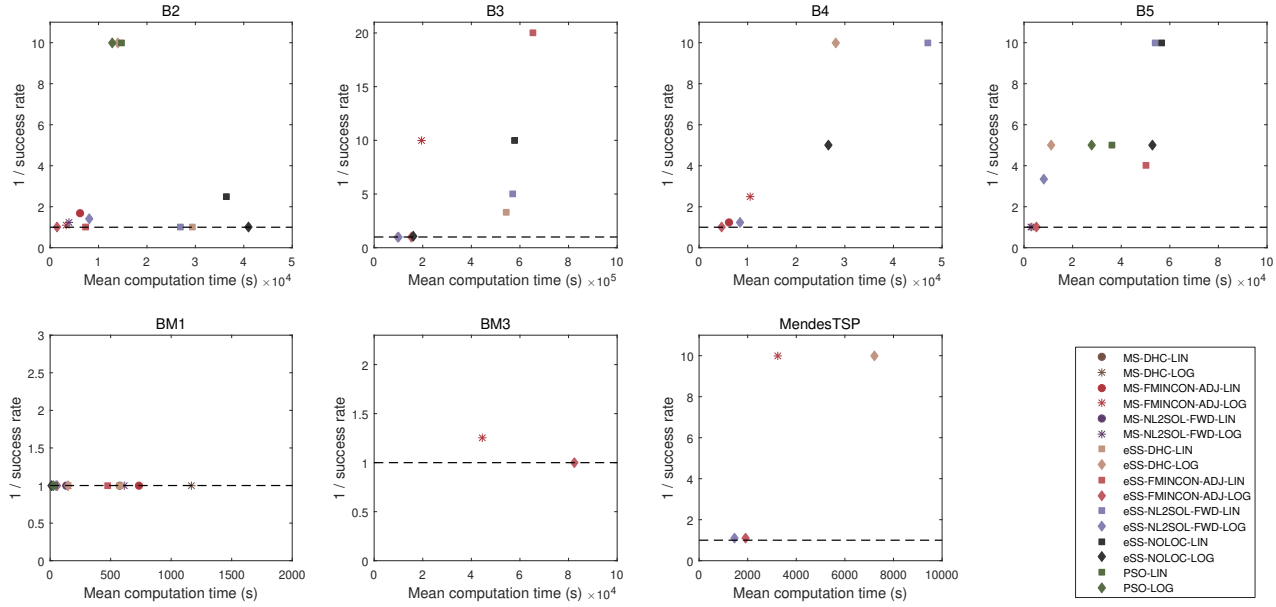

Figure S44: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR H and MAXT B from Table S1.

4.1.17 VTR I, MAXT A

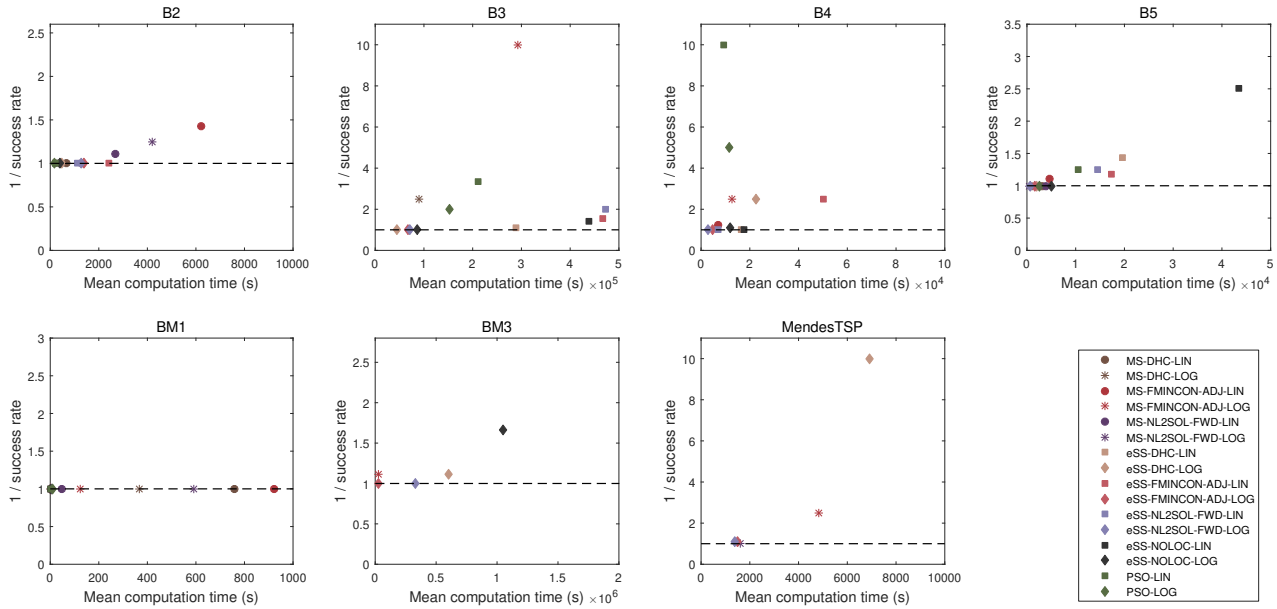

Figure S45: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR I and MAXT A from Table S1.

4.1.18 VTR I, MAXT B

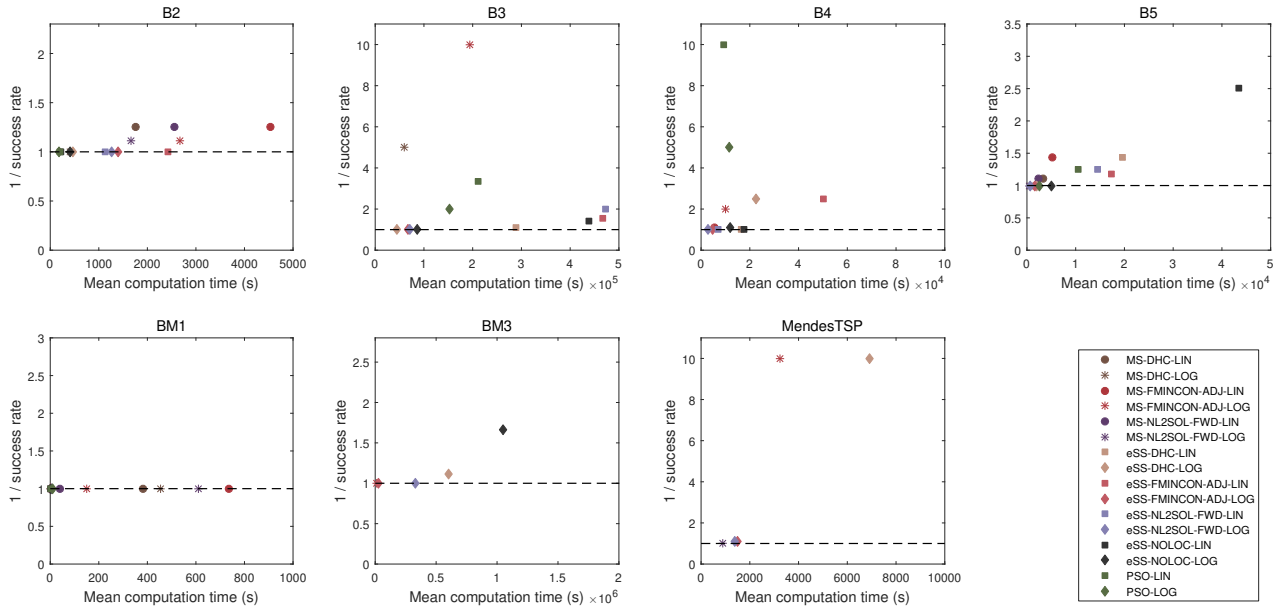

Figure S46: Dispersion plot of the inverse of the success rate versus the computation time (in seconds) of each method for every benchmark, using VTR I and MAXT B from Table S1.

4.2 Overall efficiency (OE)

4.2.1 VTR A, MAXT A

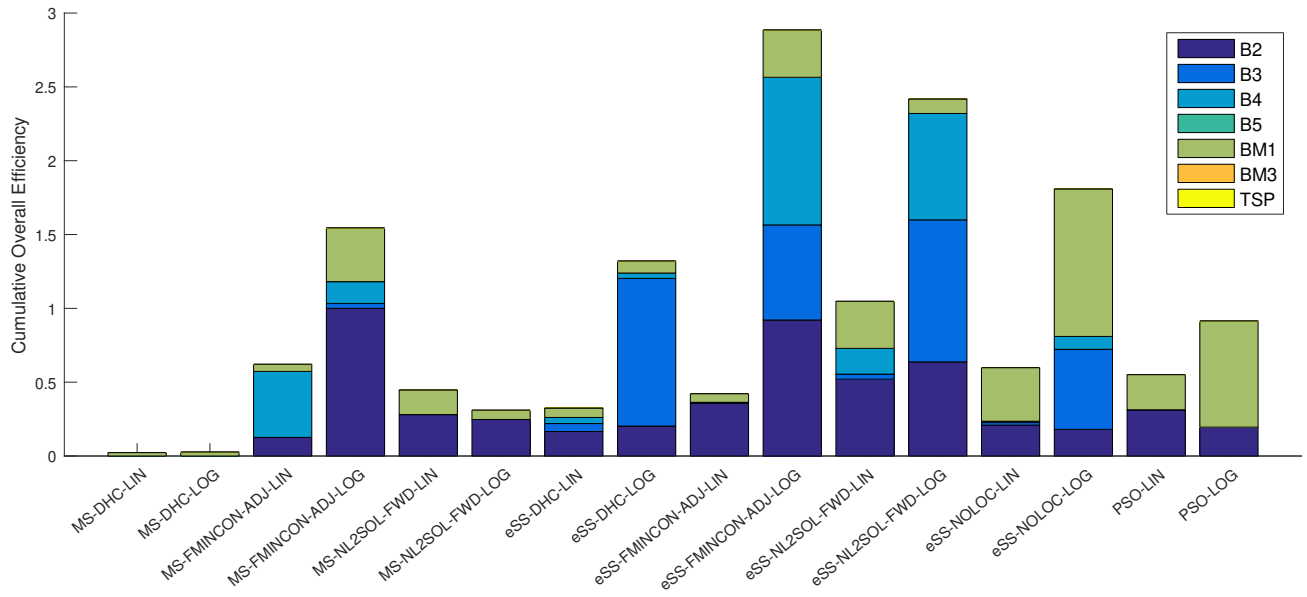

Figure S47: Overall efficiency (OE) of every method for all benchmarks, using VTR A and MAXT A from Table S1; taller bars indicate better performance.

4.2.2 VTR A, MAXT B

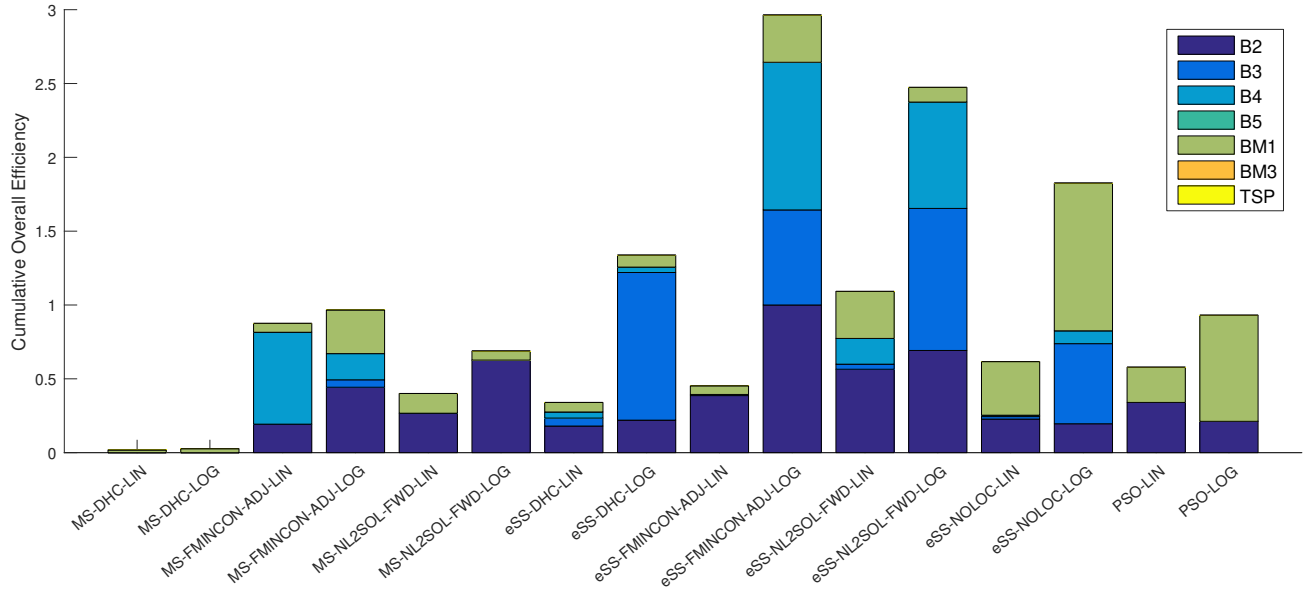

Figure S48: Overall efficiency (OE) of every method for all benchmarks, using VTR A and MAXT B from Table S1; taller bars indicate better performance.

4.2.3 VTR B, MAXT A

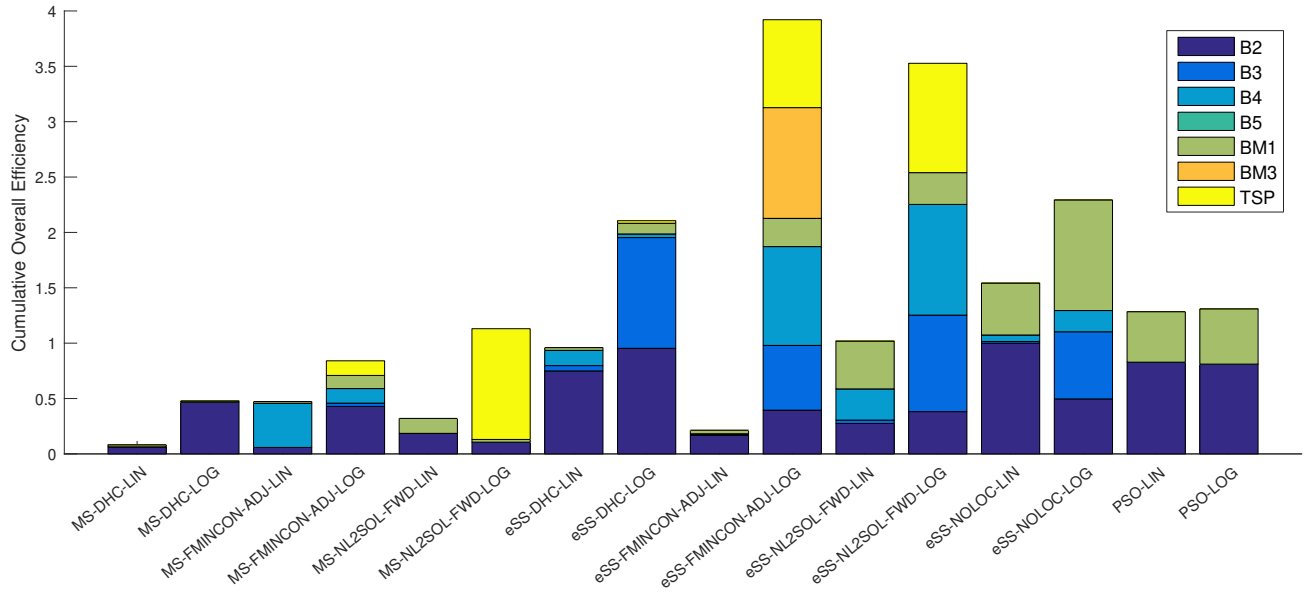

Figure S49: Overall efficiency (OE) of every method for all benchmarks, using VTR B and MAXT A from Table S1; taller bars indicate better performance.

4.2.4 VTR B, MAXT B

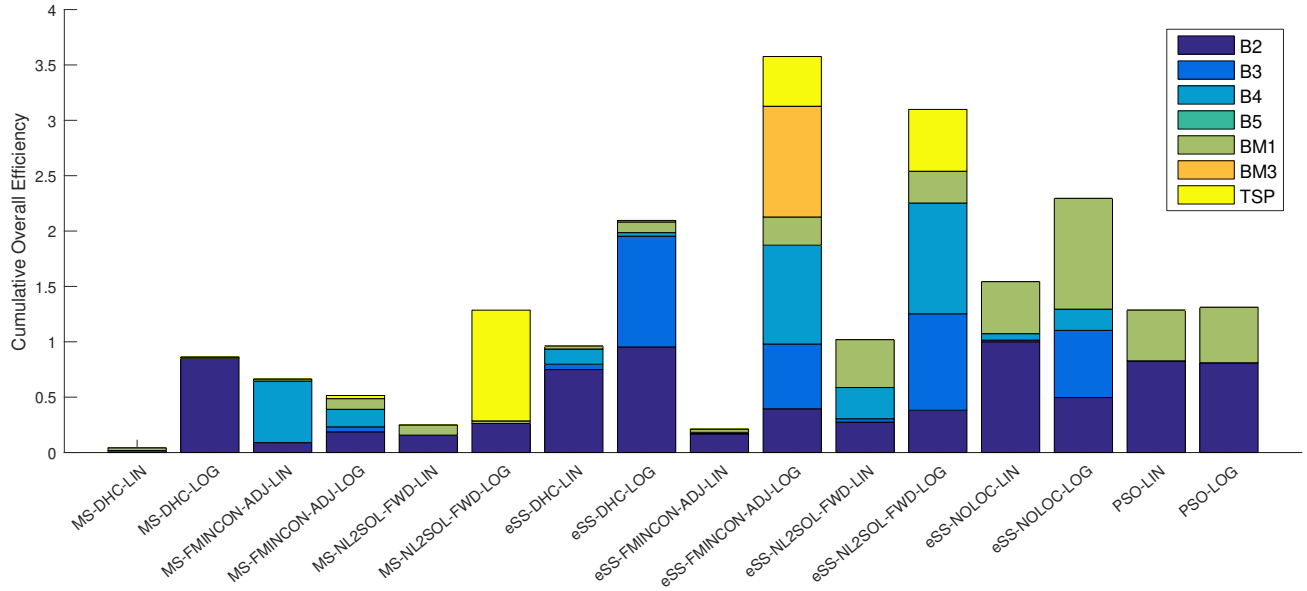

Figure S50: Overall efficiency (OE) of every method for all benchmarks, using VTR B and MAXT B from Table S1; taller bars indicate better performance.

4.2.5 VTR C, MAXT A

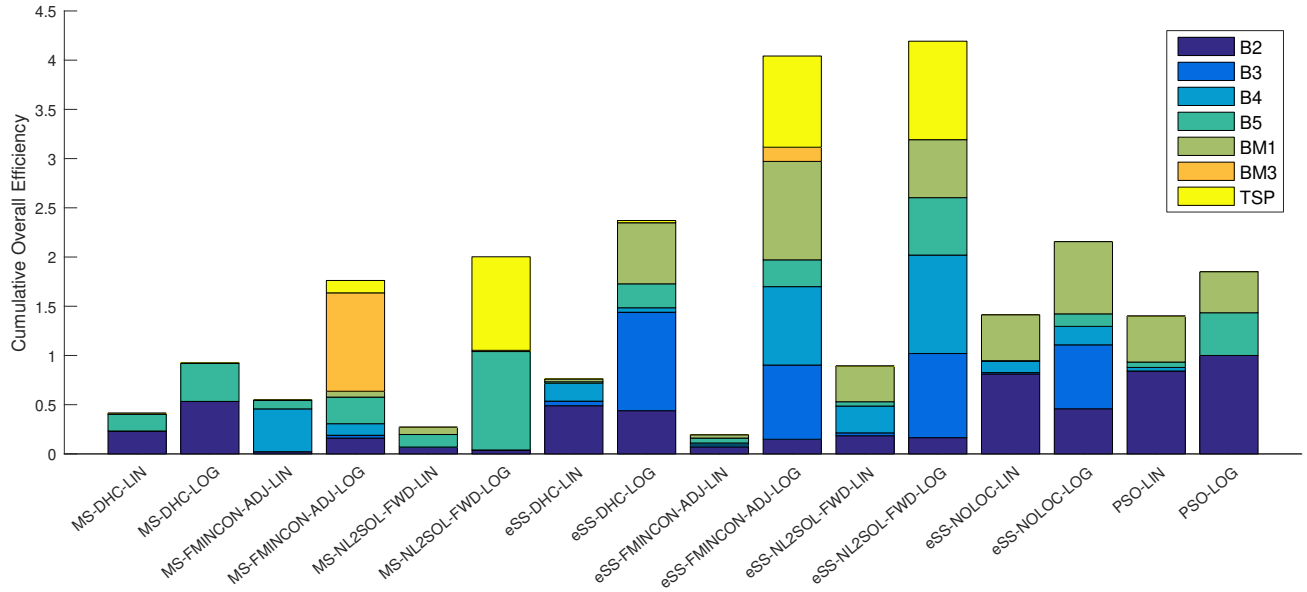

Figure S51: Overall efficiency (OE) of every method for all benchmarks, using VTR C and MAXT A from Table S1; taller bars indicate better performance.

4.2.6 VTR C, MAXT B

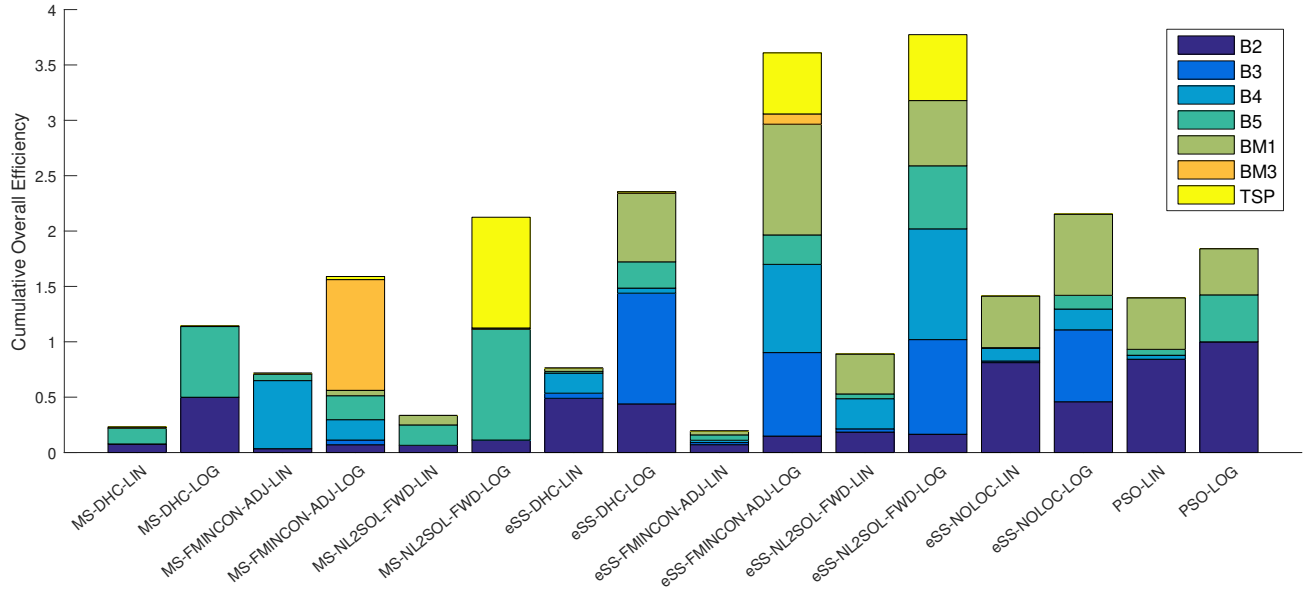

Figure S52: Overall efficiency (OE) of every method for all benchmarks, using VTR C and MAXT B from Table S1; taller bars indicate better performance.

4.2.7 VTR D, MAXT A

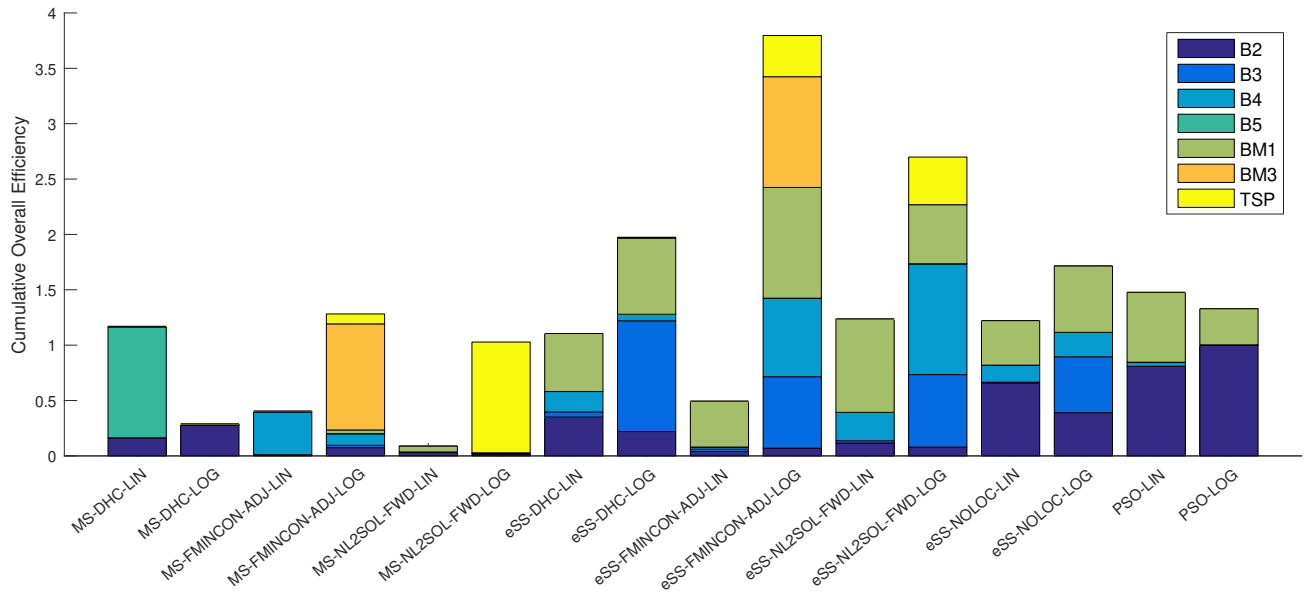

Figure S53: Overall efficiency (OE) of every method for all benchmarks, using VTR D and MAXT A from Table S1; taller bars indicate better performance.

4.2.8 VTR D, MAXT B

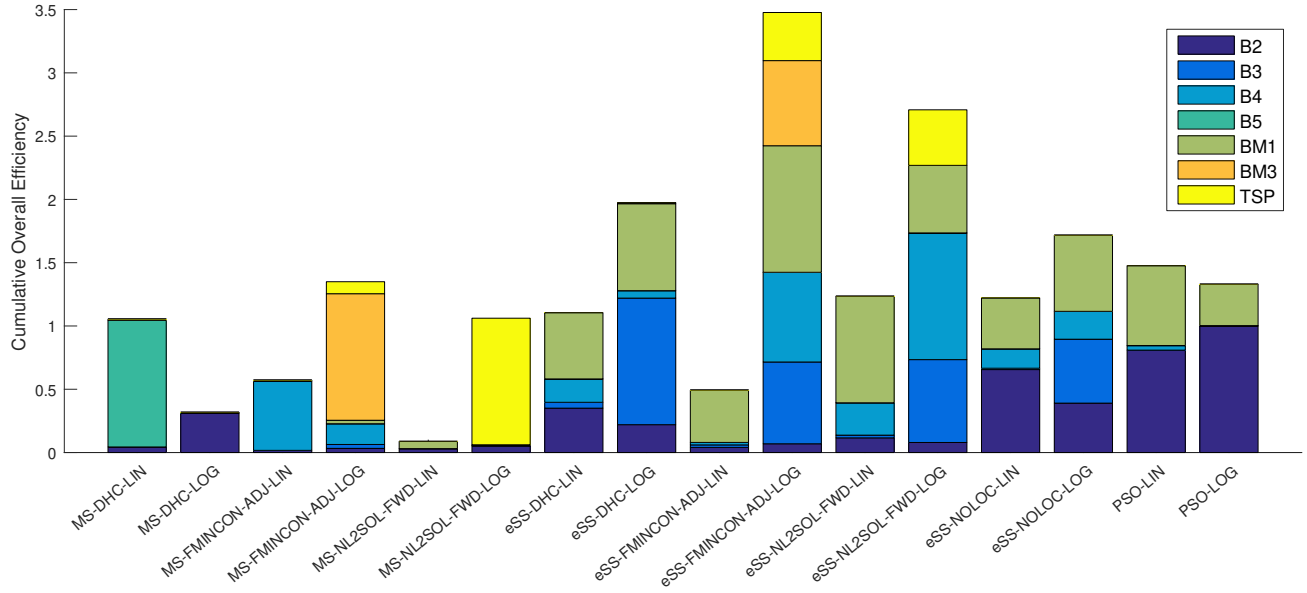

Figure S54: Overall efficiency (OE) of every method for all benchmarks, using VTR D and MAXT B from Table S1; taller bars indicate better performance.

4.2.9 VTR E, MAXT A

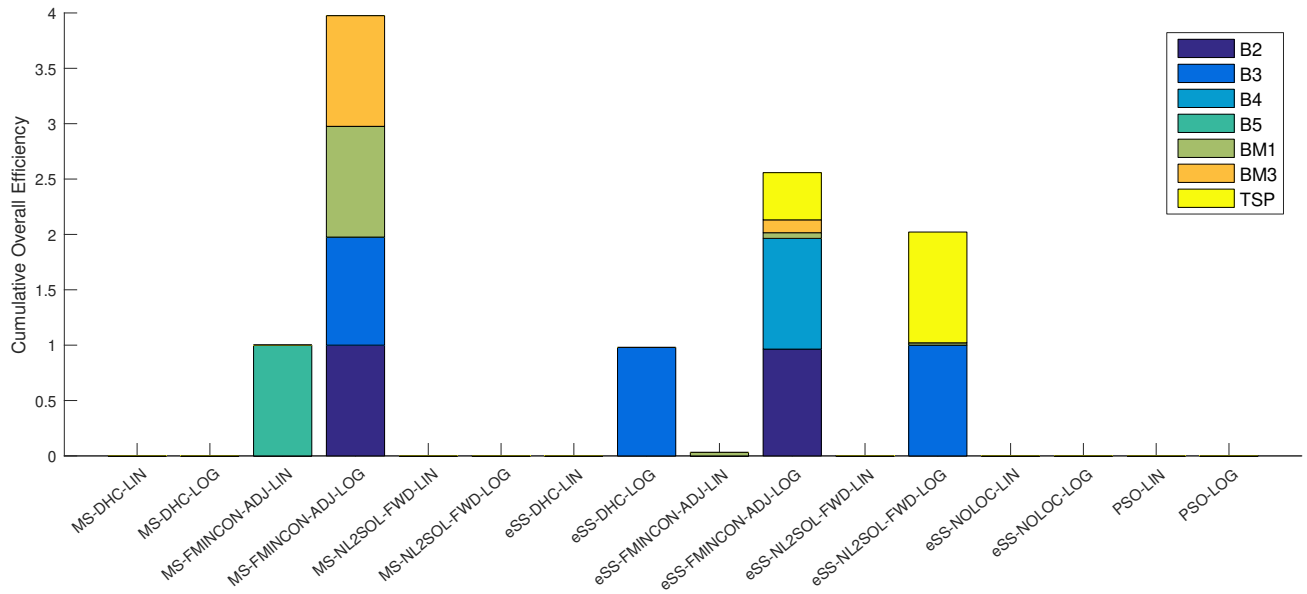

Figure S55: Overall efficiency (OE) of every method for all benchmarks, using VTR E and MAXT A from Table S1; taller bars indicate better performance.

4.2.10 VTR E, MAXT B

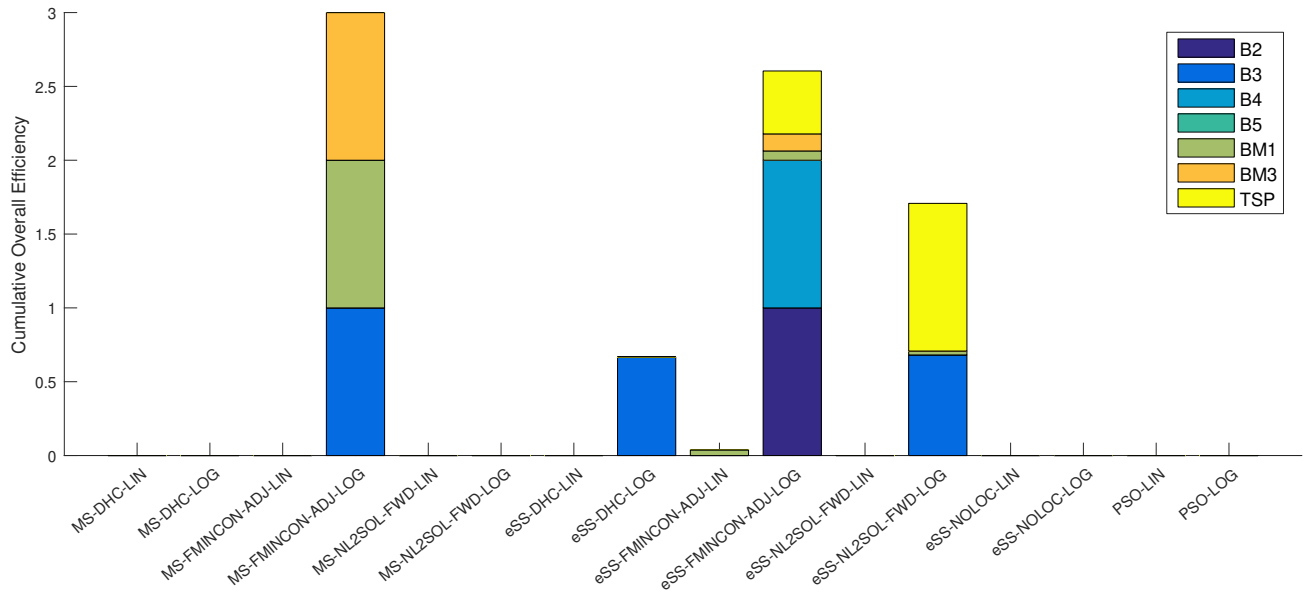

Figure S56: Overall efficiency (OE) of every method for all benchmarks, using VTR E and MAXT B from Table S1; taller bars indicate better performance.

4.2.11 VTR F, MAXT A

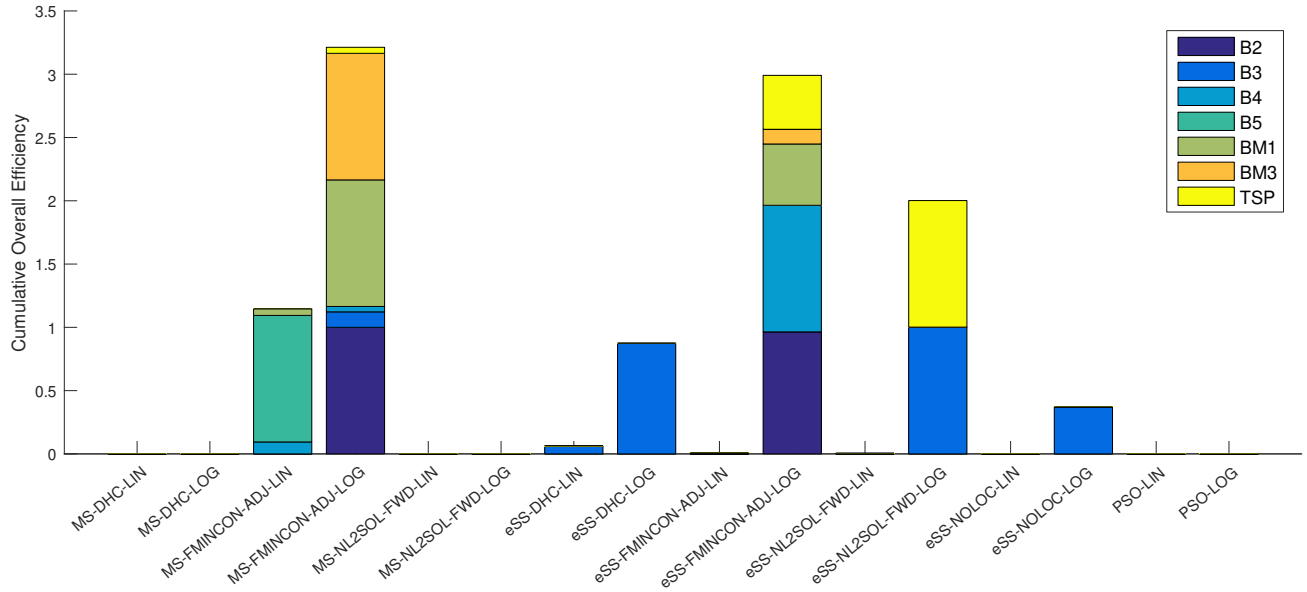

Figure S57: Overall efficiency (OE) of every method for all benchmarks, using VTR F and MAXT A from Table S1; taller bars indicate better performance.

4.2.12 VTR F, MAXT B

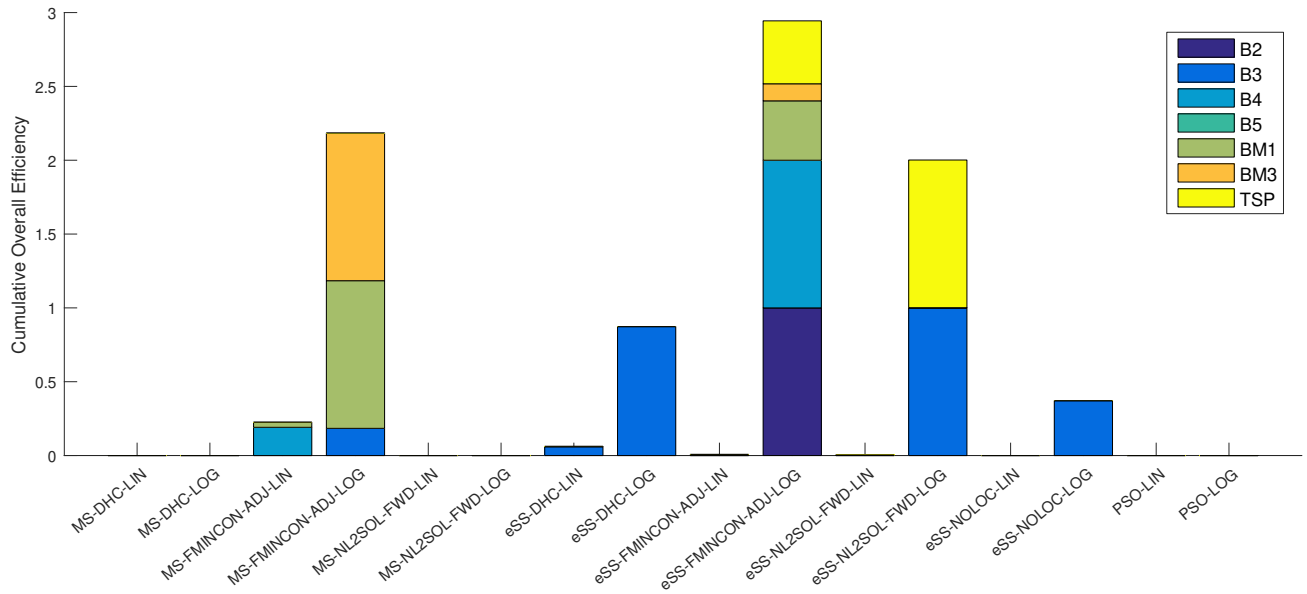

Figure S58: Overall efficiency (OE) of every method for all benchmarks, using VTR F and MAXT B from Table S1; taller bars indicate better performance.

4.2.13 VTR G, MAXT A

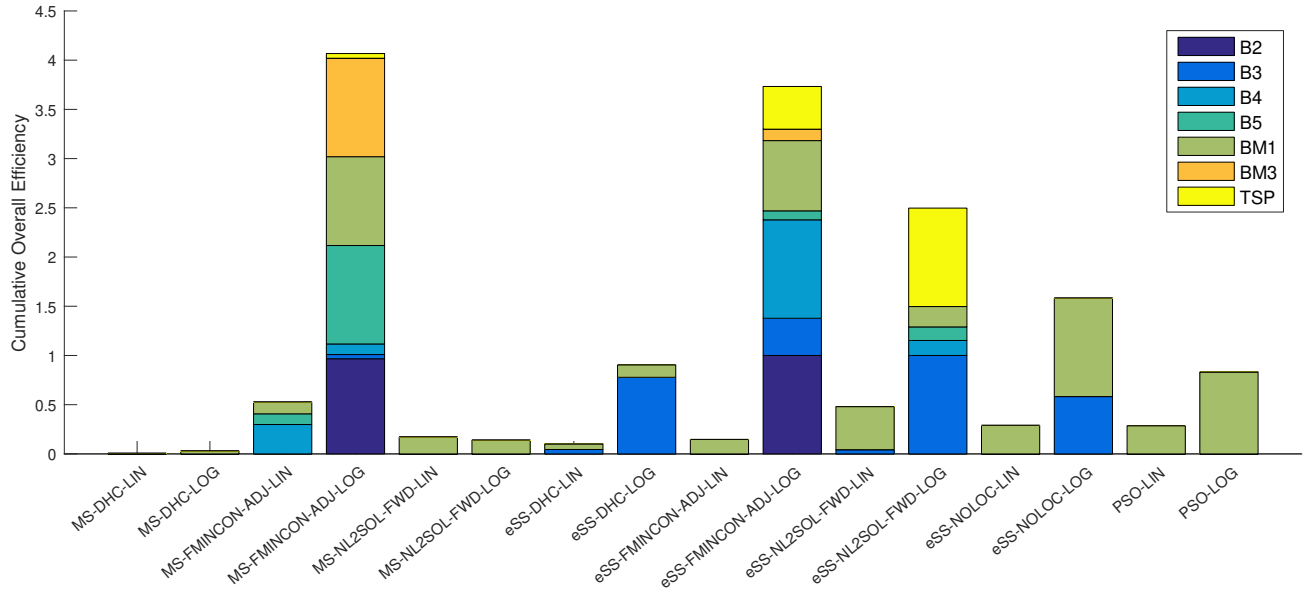

Figure S59: Overall efficiency (OE) of every method for all benchmarks, using VTR G and MAXT A from Table S1; taller bars indicate better performance.

4.2.14 VTR G, MAXT B

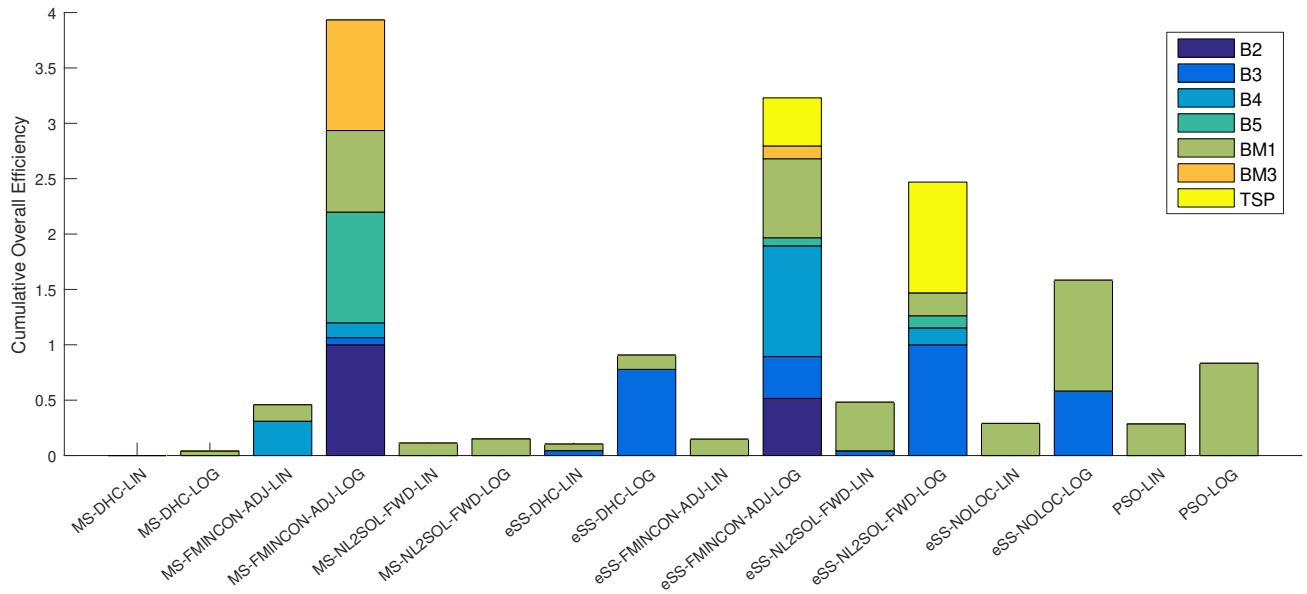

Figure S60: Overall efficiency (OE) of every method for all benchmarks, using VTR G and MAXT B from Table S1; taller bars indicate better performance.

4.2.15 VTR H, MAXT A

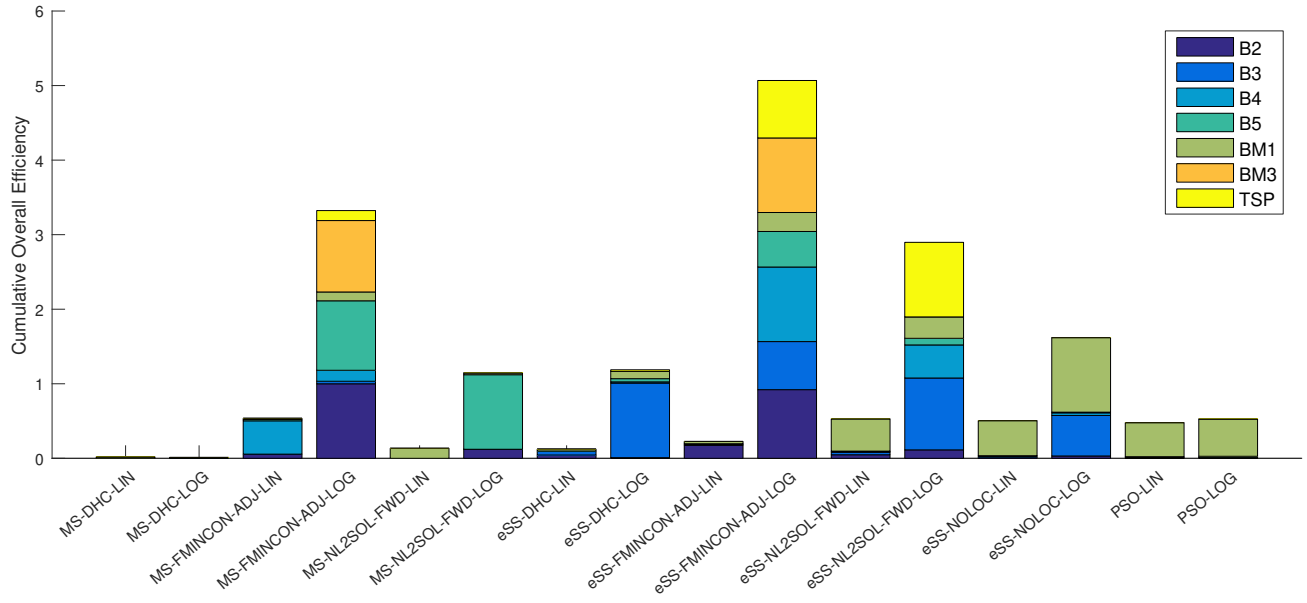

Figure S61: Overall efficiency (OE) of every method for all benchmarks, using VTR H and MAXT A from Table S1; taller bars indicate better performance.

4.2.16 VTR H, MAXT B

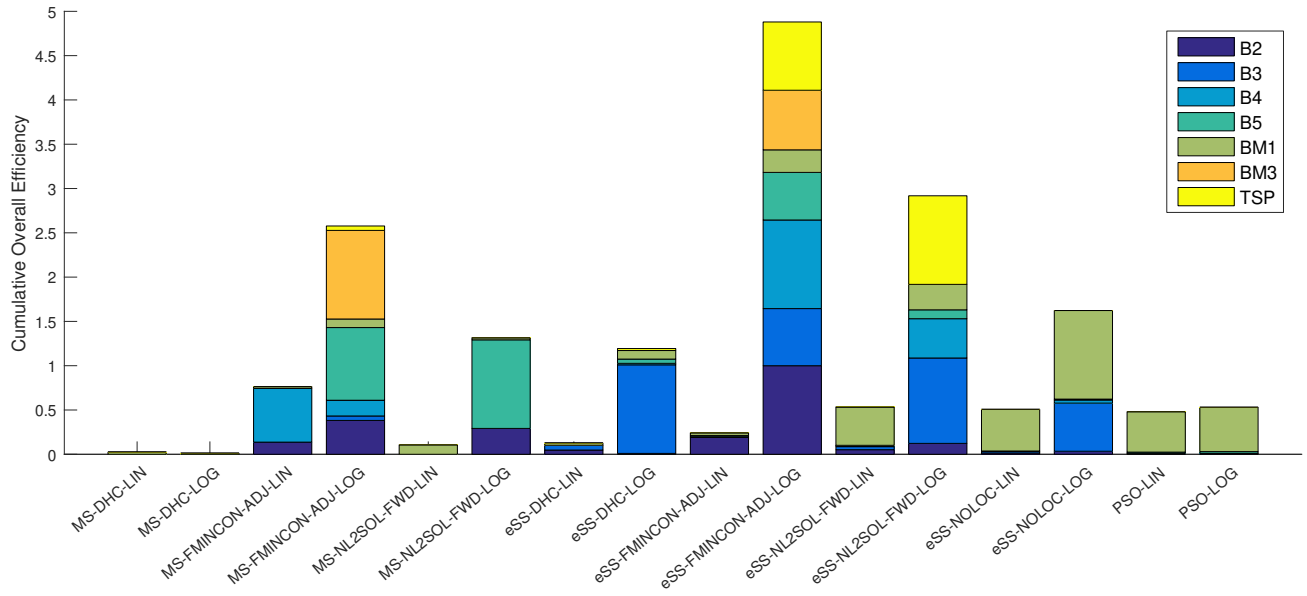

Figure S62: Overall efficiency (OE) of every method for all benchmarks, using VTR H and MAXT B from Table S1; taller bars indicate better performance.

4.2.17 VTR I, MAXT A

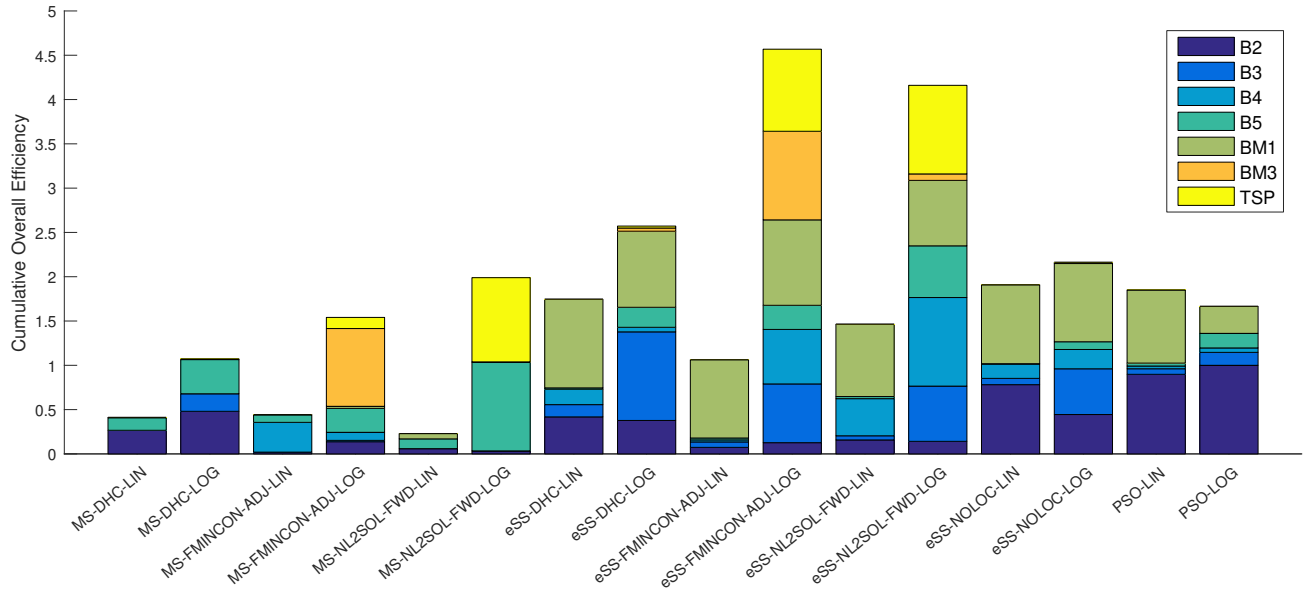

Figure S63: Overall efficiency (OE) of every method for all benchmarks, using VTR I and MAXT A from Table S1; taller bars indicate better performance.

4.2.18 VTR I, MAXT B

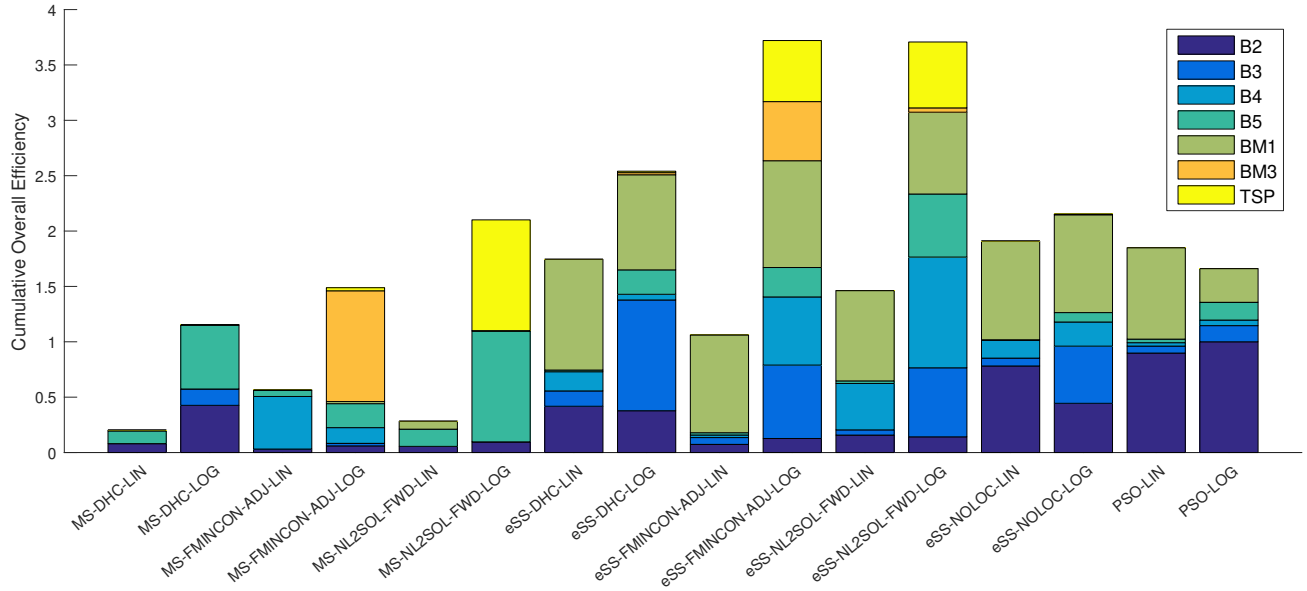

Figure S64: Overall efficiency (OE) of every method for all benchmarks, using VTR I and MAXT B from Table S1; taller bars indicate better performance.

4.3 Performance analysis from horizontal and vertical views

4.3.1 VTR A, MAXT A

Table S3: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR A; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.4887 ± 0.008882	210481 ± 123932	6386 ± 3667	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	90
B2	eSS-NOLOC-LOG	0.4945 ± 0.00674	276333 ± 59217	7178 ± 2284	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	90
B2	eSS-NL2SOL-FWD-LOG	0.4116 ± 0.04182	10439 ± 9072	2031 ± 1937	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	100
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.5977 ± 0.02913	11600 ± 0	13146 ± 75	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	0
B2	MS-NL2SOL-FWD-LOG	0.391 ± 0.04693	293 ± 102	4185 ± 5170	0.3678 ± 0.02136	167 ± 196	9233 ± 725	80
B2	PSO-LOG	0.5167 ± 0.03896	247360 ± 136717	5302 ± 3472	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	86
B2	eSS-FMINCON-ADJ-LIN	0.386 ± 0.04002	11937 ± 9382	3635 ± 1713	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	100
B2	eSS-DHC-LIN	0.4969 ± 0.004592	401156 ± 129626	7801 ± 2546	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	80
B2	eSS-NOLOC-LIN	0.4957 ± 0.008373	413509 ± 242199	6182 ± 3784	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	90
B2	eSS-NL2SOL-FWD-LIN	0.3958 ± 0.02519	22756 ± 18801	2488 ± 1585	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	100
B2	MS-FMINCON-ADJ-LIN	0.4233 ± 0.03885	3892 ± 1818	7191 ± 5686	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	60
B2	MS-DHC-LIN	0.7281 ± 0.03608	10297 ± 3533	13112 ± 89	0.739 ± 0.04345	11420 ± 569	9889 ± 102	0
B2	MS-NL2SOL-FWD-LIN	0.4212 ± 0.02841	583 ± 494	4150 ± 3620	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	90
B2	PSO-LIN	0.5012 ± 0.00566	177590 ± 97652	3719 ± 2045	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	0.4667 ± 0.03359	111289 ± 75914	152068 ± 118213	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	30
B3	eSS-DHC-LOG	0.295 ± 0.1298	120285 ± 164966	97902 ± 28123	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	50
B3	eSS-NOLOC-LOG	0.4801 ± 0.04364	302578 ± 773993	162431 ± 99453	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	10
B3	eSS-NL2SOL-FWD-LOG	0.4696 ± 0.02582	119484 ± 136023	101771 ± 35427	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	60
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.697 ± 1.853	160407 ± 224357	654282 ± 139941	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.319 ± 1.907	883431 ± 1269560	544153 ± 129638	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.059 ± 1.805	812261 ± 1655188	578236 ± 96052	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.852 ± 2.084	211578 ± 325261	570921 ± 91532	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.522 ± 2.594	1174370 ± 354809	25606 ± 7216	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	10
B4	eSS-NOLOC-LOG	0.97 ± 1.131	1129191 ± 501778	21499 ± 9569	3.766 ± 4.028	532986 ± 34062	9925 ± 74	20
B4	eSS-NL2SOL-FWD-LOG	0.3282 ± 0.16	255696 ± 413266	5843 ± 9430	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	80
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.5779 ± 0.1162	2814150 ± 506243	45324 ± 7693	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.762 ± 0.2372	3214875 ± 183933	50329 ± 251	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.5779 ± 0.3666	1230438 ± 675315	24132 ± 14389	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	0
B4	MS-FMINCON-ADJ-LIN	0.08469 ± 0.02702	6095 ± 5686	8372 ± 6149	3152 ± 8915	1360 ± 3299	4588 ± 3496	60
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	0
B5	MS-FMINCON-ADJ-LOG	0.853 ± 0.002345	478 ± 180	13633 ± 411	0.8535 ± 0.002632	486 ± 143	9351 ± 545	0
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8562 ± 0.001112	131 ± 150	13135 ± 126	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1211 ± 207	14468 ± 1228	0.938 ± 0.05679	93 ± 292	7879 ± 1757	0
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	0

Table S3 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR A; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.439 ± 0.02085	844 ± 283	138 ± 121	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.4533 ± 0.0176	18196 ± 15037	548 ± 443	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	70
BM1	eSS-NOLOC-LOG	0.4776 ± 0.01775	1586 ± 325	44 ± 10	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.4436 ± 0.01186	577 ± 38	445 ± 266	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.4701 ± 0.03855	26722 ± 13127	1350 ± 535	9.84 ± 27	6449 ± 8049	396 ± 345	30
BM1	MS-NL2SOL-FWD-LOG	0.4451 ± 0.01311	75 ± 31	708 ± 423	12.09 ± 36.8	44 ± 32	636 ± 266	80
BM1	PSO-LOG	0.4853 ± 0.01202	1850 ± 583	62 ± 18	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.4388 ± 0.00624	1344 ± 538	749 ± 509	0.6322 ± 0.2762	736 ± 351	228 ± 235	60
BM1	eSS-DHC-LIN	0.4608 ± 0.02213	27534 ± 15526	686 ± 360	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	90
BM1	eSS-NOLOC-LIN	0.4862 ± 0.009987	4552 ± 1950	122 ± 49	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.4707 ± 0.02068	3307 ± 2225	139 ± 86	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.4878 ± 0.04507	30436 ± 12290	1316 ± 668	13.58 ± 27.47	24370 ± 16289	618 ± 347	30
BM1	MS-NL2SOL-FWD-LIN	0.4581 ± 0.01452	16 ± 5	263 ± 346	0.4566 ± 0.01809	9 ± 4	978 ± 14	90
BM1	PSO-LIN	0.4939 ± 0.007017	7230 ± 5197	186 ± 130	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	385922 ± 12076	608242 ± 1129	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	2759 ± 1398	137709 ± 6525	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	0
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	64719 ± 22468	7363 ± 154	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	0
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	100419 ± 5319	7216 ± 6	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	0
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1599 ± 1981	5251 ± 825	104.1 ± 309.2	362 ± 318	2513 ± 1237	0
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

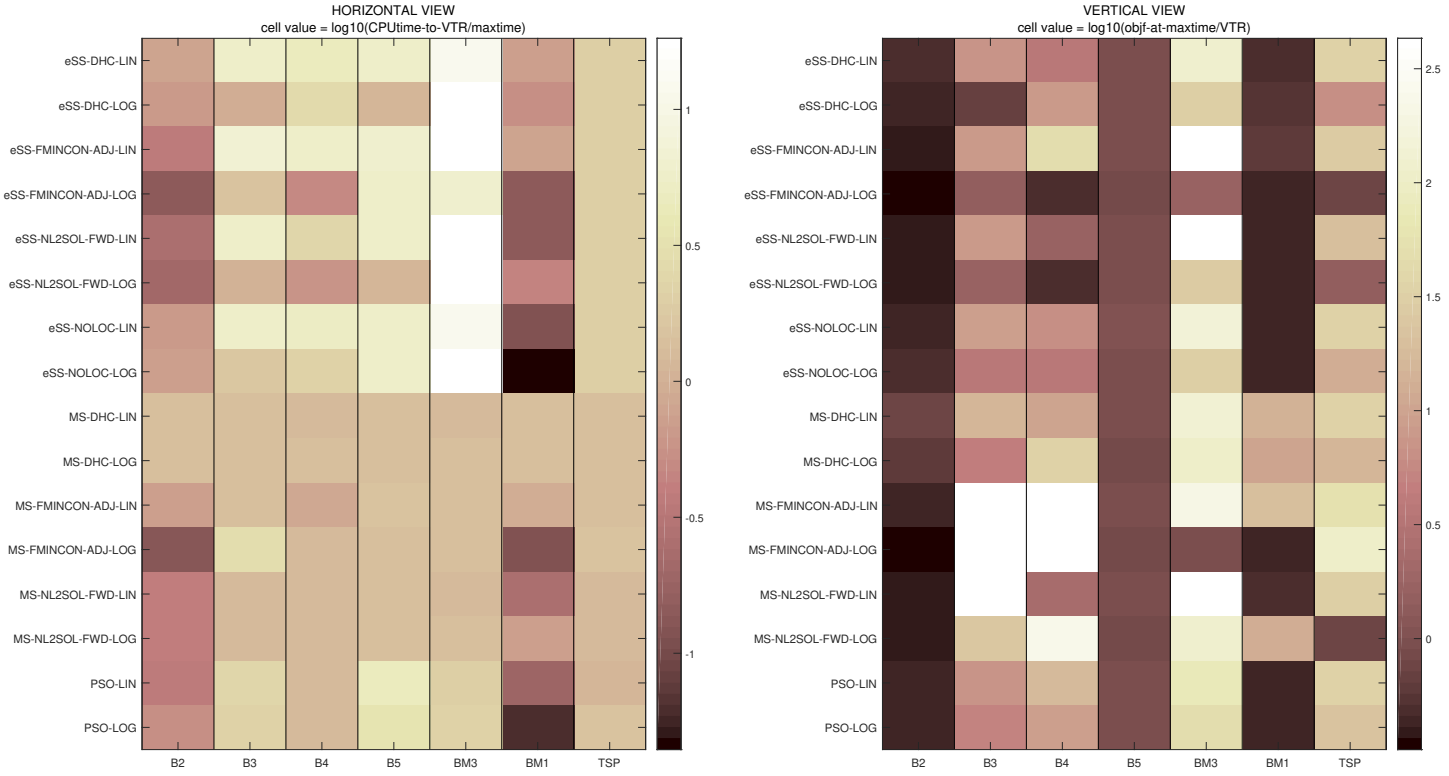

Figure S65: Result summary of horizontal and vertical views with VTR A, MAXT A in Table S1.

4.3.2 VTR A, MAXT B

Table S4: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR A; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.4887 ± 0.008882	210481 ± 123932	6386 ± 3667	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	40
B2	eSS-NOLOC-LOG	0.4945 ± 0.00674	276333 ± 59217	7178 ± 2284	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	10
B2	eSS-NL2SOL-FWD-LOG	0.4116 ± 0.04182	10439 ± 9072	2031 ± 1937	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	90
B2	MS-FMINCON-ADJ-LOG	0.3511 ± 0.04246	2262 ± 1160	2856 ± 3558	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	90
B2	MS-DHC-LOG	0.6185 ± 0.03374	11567 ± 104	6626 ± 86	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	0
B2	MS-NL2SOL-FWD-LOG	0.4034 ± 0.03587	278 ± 101	2018 ± 1798	0.3743 ± 0.01805	106 ± 157	4570 ± 438	90
B2	PSO-LOG	0.5167 ± 0.03896	247360 ± 136717	5302 ± 3472	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	60
B2	eSS-FMINCON-ADJ-LIN	0.386 ± 0.04002	11937 ± 9382	3635 ± 1713	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	70
B2	eSS-DHC-LIN	0.4969 ± 0.004592	401156 ± 129626	7801 ± 2546	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	10
B2	eSS-NOLOC-LIN	0.4957 ± 0.008373	413509 ± 242199	6182 ± 3784	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	60
B2	eSS-NL2SOL-FWD-LIN	0.3958 ± 0.02519	22756 ± 18801	2488 ± 1585	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	90
B2	MS-FMINCON-ADJ-LIN	0.4222 ± 0.1264	4641 ± 1834	5099 ± 2382	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	60
B2	MS-DHC-LIN	0.7796 ± 0.04802	11600 ± 0	6704 ± 114	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	0
B2	MS-NL2SOL-FWD-LIN	0.4248 ± 0.02263	756 ± 526	4210 ± 2502	0.4438 ± 0.04447	216 ± 468	4370 ± 804	70
B2	PSO-LIN	0.5012 ± 0.00566	177590 ± 97652	3719 ± 2045	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	63
B3	eSS-FMINCON-ADJ-LOG	0.4667 ± 0.03359	111289 ± 75914	152068 ± 118213	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.295 ± 0.1298	120285 ± 164966	97902 ± 28123	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	0
B3	eSS-NOLOC-LOG	0.4801 ± 0.04364	302578 ± 773993	162431 ± 99453	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.4696 ± 0.02582	119484 ± 136023	101771 ± 35427	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.697 ± 1.853	160407 ± 224357	654282 ± 139941	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.319 ± 1.907	883431 ± 1269560	544153 ± 129638	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.059 ± 1.805	812261 ± 1655188	578236 ± 96052	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.852 ± 2.084	211578 ± 325261	570921 ± 91532	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.522 ± 2.594	1174370 ± 354809	25606 ± 7216	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	0.97 ± 1.131	1129191 ± 501778	21499 ± 9569	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.3282 ± 0.16	255696 ± 413266	5843 ± 9430	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	80
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3767 ± 5512	10536 ± 7182	16.71 ± 36.7	337 ± 692	2370 ± 1501	30
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.5779 ± 0.1162	2814150 ± 506243	45324 ± 7693	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.762 ± 0.2372	3214875 ± 183933	50329 ± 251	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.5779 ± 0.3666	1230438 ± 675315	24132 ± 14389	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	0
B4	MS-FMINCON-ADJ-LIN	0.2125 ± 0.2626	4063 ± 5470	6012 ± 4194	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	50
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	0
B5	MS-FMINCON-ADJ-LOG	0.8542 ± 0.003445	603 ± 159	7089 ± 497	0.8561 ± 0.004511	546 ± 125	4322 ± 407	0
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8567 ± 0.001715	90 ± 25	6711 ± 95	0.8594 ± 0.004863	74 ± 26	4789 ± 180	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S4 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR A; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.439 ± 0.02085	844 ± 283	138 ± 121	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	0.4533 ± 0.0176	18196 ± 15037	548 ± 443	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	60
BM1	eSS-NOLOC-LOG	0.4776 ± 0.01775	1586 ± 325	44 ± 10	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	0.4436 ± 0.01186	577 ± 38	445 ± 266	0.5228 ± 0.0997	773 ± 741	176 ± 183	60
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	0.4675 ± 0.03976	27977 ± 11774	1308 ± 499	29.88 ± 60.84	3571 ± 4656	220 ± 188	10
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	69 ± 27	652 ± 320	85.38 ± 131.2	12 ± 21	126 ± 176	20
BM1	PSO-LOG	0.4853 ± 0.01202	1850 ± 583	62 ± 18	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	0.4388 ± 0.00624	1344 ± 538	749 ± 509	0.6407 ± 0.2708	658 ± 294	160 ± 176	50
BM1	eSS-DHC-LIN	0.4608 ± 0.02213	27534 ± 15526	686 ± 360	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	30
BM1	eSS-NOLOC-LIN	0.4862 ± 0.009987	4552 ± 1950	122 ± 49	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	100
BM1	eSS-NL2SOL-FWD-LIN	0.4707 ± 0.02068	3307 ± 2225	139 ± 86	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.5197 ± 0.06227	32162 ± 10515	950 ± 347	9.56 ± 19.85	4233 ± 5527	133 ± 134	20
BM1	MS-NL2SOL-FWD-LIN	0.4671 ± 0.02298	18 ± 6	298 ± 223	0.4922 ± 0.07692	12 ± 6	479 ± 20	80
BM1	PSO-LIN	0.4939 ± 0.007017	7230 ± 5197	186 ± 130	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	385922 ± 12076	608242 ± 1129	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.019 ± 0.3833	2415 ± 1294	73881 ± 5740	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	0
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	64719 ± 22468	7363 ± 154	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	0
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	100419 ± 5319	7216 ± 6	1.518 ± 2.562	16140 ± 8294	1180 ± 556	0
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	1969 ± 2403	3440 ± 1342	12.85 ± 17.1	452 ± 388	1119 ± 499	0
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	326 ± 241	2356 ± 13	0.7633 ± 0.2003	72 ± 170	1785 ± 9	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

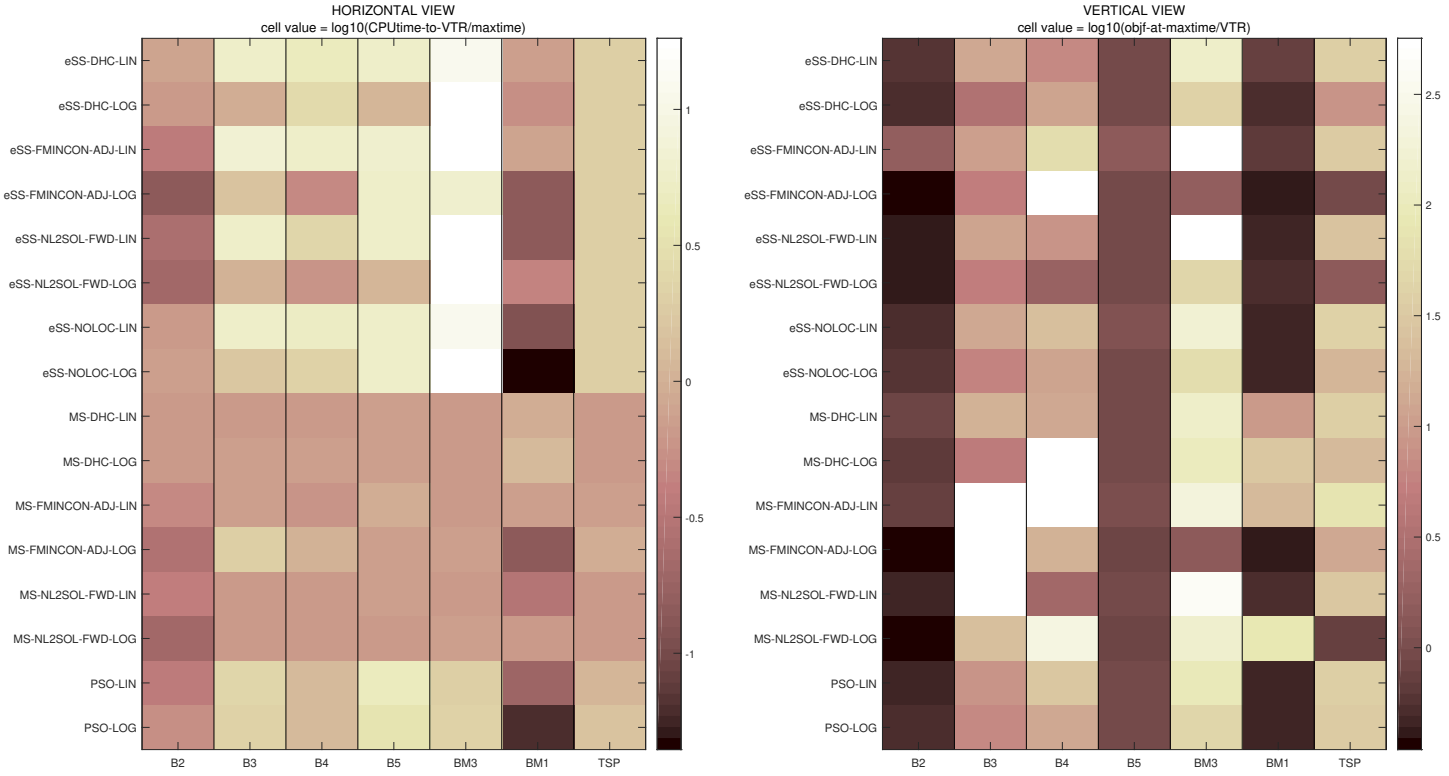

Figure S66: Result summary of horizontal and vertical views with VTR A, MAXT B in Table S1.

4.3.3 VTR B, MAXT A

Table S5: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR B; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.6327 ± 0.05331	18653 ± 10171	582 ± 310	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	100
B2	eSS-NOLOC-LOG	0.7432 ± 0.008364	43401 ± 12086	1118 ± 336	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.4795 ± 0.1303	6260 ± 5812	1454 ± 882	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	100
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.6918 ± 0.05216	11580 ± 64	1187 ± 783	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	100
B2	MS-NL2SOL-FWD-LOG	0.391 ± 0.04693	293 ± 102	4185 ± 5170	0.3678 ± 0.02136	167 ± 196	9233 ± 725	80
B2	PSO-LOG	0.7486 ± 0.001784	34260 ± 31768	684 ± 610	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.4077 ± 0.08066	10296 ± 6367	3300 ± 1929	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	100
B2	eSS-DHC-LIN	0.7001 ± 0.03264	37069 ± 25902	741 ± 501	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	100
B2	eSS-NOLOC-LIN	0.7437 ± 0.007118	37959 ± 5827	555 ± 84	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	100
B2	eSS-NL2SOL-FWD-LIN	0.4621 ± 0.1442	14830 ± 13381	2020 ± 1767	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	100
B2	MS-FMINCON-ADJ-LIN	0.4698 ± 0.1172	3896 ± 1823	6644 ± 5546	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	70
B2	MS-DHC-LIN	0.7341 ± 0.0336	9938 ± 3466	6920 ± 4312	0.739 ± 0.04345	11420 ± 569	9889 ± 102	70
B2	MS-NL2SOL-FWD-LIN	0.5013 ± 0.06604	507 ± 544	2691 ± 3893	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	90
B2	PSO-LIN	0.7436 ± 0.01305	32460 ± 16192	670 ± 316	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	0.6454 ± 0.09259	103491 ± 78035	149088 ± 118646	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	30
B3	eSS-DHC-LOG	0.3753 ± 0.2069	101983 ± 155227	87204 ± 26221	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	60
B3	eSS-NOLOC-LOG	0.6935 ± 0.06009	213242 ± 521775	143822 ± 52675	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	10
B3	eSS-NL2SOL-FWD-LOG	0.6684 ± 0.1013	112867 ± 138331	100088 ± 33878	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	60
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.71 ± 1.83	160113 ± 224187	654256 ± 139963	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.404 ± 1.815	882248 ± 1269695	543352 ± 129901	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.07 ± 1.782	812064 ± 1654967	578219 ± 96105	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.893 ± 2.01	210985 ± 324367	570865 ± 91650	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.55 ± 2.559	1164580 ± 374665	25389 ± 7664	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	10
B4	eSS-NOLOC-LOG	1.115 ± 1.07	923461 ± 496698	17412 ± 8992	3.766 ± 4.028	532986 ± 34062	9925 ± 74	30
B4	eSS-NL2SOL-FWD-LOG	0.4222 ± 0.2289	181799 ± 284976	4174 ± 6466	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	80
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.7298 ± 0.07106	1675972 ± 915606	27301 ± 15015	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.8261 ± 0.1958	2727966 ± 518612	42607 ± 7894	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.7254 ± 0.3258	620196 ± 428949	13325 ± 13972	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	40
B4	MS-FMINCON-ADJ-LIN	0.08469 ± 0.02702	6095 ± 5686	8372 ± 6149	3152 ± 8915	1360 ± 3299	4588 ± 3496	60
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	0
B5	MS-FMINCON-ADJ-LOG	0.853 ± 0.002345	478 ± 180	13633 ± 411	0.8535 ± 0.002632	486 ± 143	9351 ± 545	0
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8562 ± 0.001112	131 ± 150	13135 ± 126	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1211 ± 207	14468 ± 1228	0.938 ± 0.05679	93 ± 292	7879 ± 1757	0
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	0

Table S5 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR B; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.5752 ± 0.1136	462 ± 393	57 ± 109	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.5401 ± 0.08212	5332 ± 11432	149 ± 320	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	90
BM1	eSS-NOLOC-LOG	0.6277 ± 0.0708	509 ± 269	14 ± 7	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.5713 ± 0.09317	478 ± 131	50 ± 80	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.4724 ± 0.04293	27331 ± 12445	1215 ± 608	9.84 ± 27	6449 ± 8049	396 ± 345	40
BM1	MS-NL2SOL-FWD-LOG	0.4519 ± 0.03306	76 ± 30	589 ± 352	12.09 ± 36.8	44 ± 32	636 ± 266	90
BM1	PSO-LOG	0.6829 ± 0.06923	750 ± 566	29 ± 18	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.5459 ± 0.1286	947 ± 751	477 ± 613	0.6322 ± 0.2762	736 ± 351	228 ± 235	70
BM1	eSS-DHC-LIN	0.4875 ± 0.06491	22787 ± 11900	572 ± 282	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	100
BM1	eSS-NOLOC-LIN	0.6392 ± 0.06676	1113 ± 572	31 ± 15	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.6598 ± 0.08414	839 ± 566	33 ± 27	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.5625 ± 0.104	30608 ± 13383	757 ± 345	13.58 ± 27.47	24370 ± 16289	618 ± 347	80
BM1	MS-NL2SOL-FWD-LIN	0.4894 ± 0.0615	15 ± 5	107 ± 60	0.4566 ± 0.01809	9 ± 4	978 ± 14	100
BM1	PSO-LIN	0.6738 ± 0.04814	1160 ± 508	32 ± 13	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	2759 ± 1398	137709 ± 6525	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	0
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7734 ± 0.3181	14088 ± 30552	1826 ± 1898	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	91
MendesTSP	eSS-DHC-LOG	4.594 ± 5.715	108711 ± 17394	7007 ± 1169	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.486 ± 2.571	19895 ± 31978	1454 ± 2181	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	90
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1668 ± 1940	4829 ± 1696	104.1 ± 309.2	362 ± 318	2513 ± 1237	10
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	1595 ± 1010	0.7633 ± 0.2003	68 ± 172	3583 ± 13	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

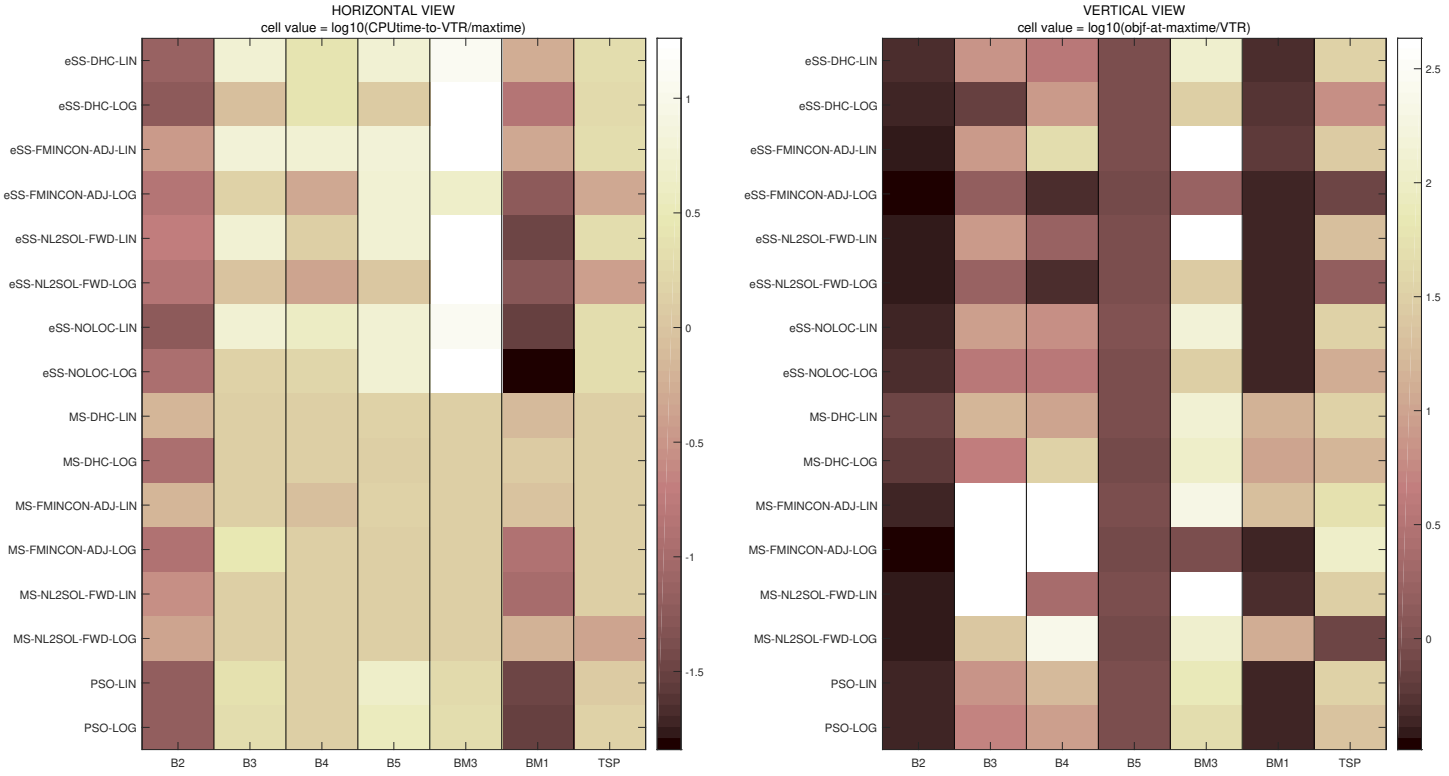

Figure S67: Result summary of horizontal and vertical views with VTR B, MAXT A in Table S1.

4.3.4 VTR B, MAXT B

Table S6: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR B; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.6327 ± 0.05331	18653 ± 10171	582 ± 310	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	100
B2	eSS-NOLOC-LOG	0.7432 ± 0.008364	43401 ± 12086	1118 ± 336	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.4795 ± 0.1303	6260 ± 5812	1454 ± 882	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	100
B2	MS-FMINCON-ADJ-LOG	0.3633 ± 0.07514	2311 ± 1181	2669 ± 3507	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	90
B2	MS-DHC-LOG	0.7224 ± 0.02753	11600 ± 0	652 ± 459	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	100
B2	MS-NL2SOL-FWD-LOG	0.4257 ± 0.0903	264 ± 122	1905 ± 1873	0.3743 ± 0.01805	106 ± 157	4570 ± 438	90
B2	PSO-LOG	0.7486 ± 0.001784	34260 ± 31768	684 ± 610	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.4077 ± 0.08066	10296 ± 6367	3300 ± 1929	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	70
B2	eSS-DHC-LIN	0.7001 ± 0.03264	37069 ± 25902	741 ± 501	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	100
B2	eSS-NOLOC-LIN	0.7437 ± 0.007118	37959 ± 5827	555 ± 84	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	100
B2	eSS-NL2SOL-FWD-LIN	0.4621 ± 0.1442	14830 ± 13381	2020 ± 1767	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	90
B2	MS-FMINCON-ADJ-LIN	0.4222 ± 0.1264	4963 ± 1676	4940 ± 2288	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	60
B2	MS-DHC-LIN	0.7796 ± 0.04802	11241 ± 758	6004 ± 1579	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	20
B2	MS-NL2SOL-FWD-LIN	0.53 ± 0.09412	426 ± 430	2824 ± 2874	0.4438 ± 0.04447	216 ± 468	4370 ± 804	80
B2	PSO-LIN	0.7436 ± 0.01305	32460 ± 16192	670 ± 316	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	0.6454 ± 0.09259	103491 ± 78035	149088 ± 118646	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.3753 ± 0.2069	101983 ± 155227	87204 ± 26221	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	10
B3	eSS-NOLOC-LOG	0.6935 ± 0.06009	213242 ± 521775	143822 ± 52675	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.6684 ± 0.1013	112867 ± 138331	100088 ± 33878	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.71 ± 1.83	160113 ± 224187	654256 ± 139963	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.404 ± 1.815	882248 ± 1269695	543352 ± 129901	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.07 ± 1.782	812064 ± 1654967	578219 ± 96105	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.893 ± 2.01	210985 ± 324367	570865 ± 91650	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.55 ± 2.559	1164580 ± 374665	25389 ± 7664	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	1.115 ± 1.07	923461 ± 496698	17412 ± 8992	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.4222 ± 0.2289	181799 ± 284976	4174 ± 6466	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	80
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3767 ± 5512	10536 ± 7182	16.71 ± 36.7	337 ± 692	2370 ± 1501	30
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.7298 ± 0.07106	1675972 ± 915606	27301 ± 15015	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.8261 ± 0.1958	2727966 ± 518612	42607 ± 7894	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.7254 ± 0.3258	620196 ± 428949	13325 ± 13972	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	30
B4	MS-FMINCON-ADJ-LIN	0.2125 ± 0.2626	4063 ± 5470	6012 ± 4194	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	50
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	0
B5	MS-FMINCON-ADJ-LOG	0.8542 ± 0.003445	603 ± 159	7089 ± 497	0.8561 ± 0.004511	546 ± 125	4322 ± 407	0
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8567 ± 0.001715	90 ± 25	6711 ± 95	0.8594 ± 0.004863	74 ± 26	4789 ± 180	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S6 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR B; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.5752 ± 0.1136	462 ± 393	57 ± 109	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	0.5401 ± 0.08212	5332 ± 11432	149 ± 320	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	90
BM1	eSS-NOLOC-LOG	0.6277 ± 0.0708	509 ± 269	14 ± 7	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	0.5713 ± 0.09317	478 ± 131	50 ± 80	0.5228 ± 0.0997	773 ± 741	176 ± 183	100
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	0.4871 ± 0.06421	26535 ± 13717	1171 ± 619	29.88 ± 60.84	3571 ± 4656	220 ± 188	30
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	68 ± 28	611 ± 342	85.38 ± 131.2	12 ± 21	126 ± 176	30
BM1	PSO-LOG	0.6829 ± 0.06923	750 ± 566	29 ± 18	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	0.5459 ± 0.1286	947 ± 751	477 ± 613	0.6407 ± 0.2708	658 ± 294	160 ± 176	70
BM1	eSS-DHC-LIN	0.4875 ± 0.06491	22787 ± 11900	572 ± 282	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	40
BM1	eSS-NOLOC-LIN	0.6392 ± 0.06676	1113 ± 572	31 ± 15	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	100
BM1	eSS-NL2SOL-FWD-LIN	0.6598 ± 0.08414	839 ± 566	33 ± 27	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.6087 ± 0.1042	22123 ± 15944	573 ± 446	9.56 ± 19.85	4233 ± 5527	133 ± 134	40
BM1	MS-NL2SOL-FWD-LIN	0.5572 ± 0.1153	13 ± 3	155 ± 138	0.4922 ± 0.07692	12 ± 6	479 ± 20	100
BM1	PSO-LIN	0.6738 ± 0.04814	1160 ± 508	32 ± 13	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.019 ± 0.3833	2415 ± 1294	73881 ± 5740	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	0
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7734 ± 0.3181	14088 ± 30552	1826 ± 1898	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	64
MendesTSP	eSS-DHC-LOG	4.594 ± 5.715	108711 ± 17394	7007 ± 1169	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.486 ± 2.571	19895 ± 31978	1454 ± 2181	1.518 ± 2.562	16140 ± 8294	1180 ± 556	80
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	2035 ± 2360	3237 ± 1607	12.85 ± 17.1	452 ± 388	1119 ± 499	10
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	902 ± 721	0.7633 ± 0.2003	72 ± 170	1785 ± 9	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

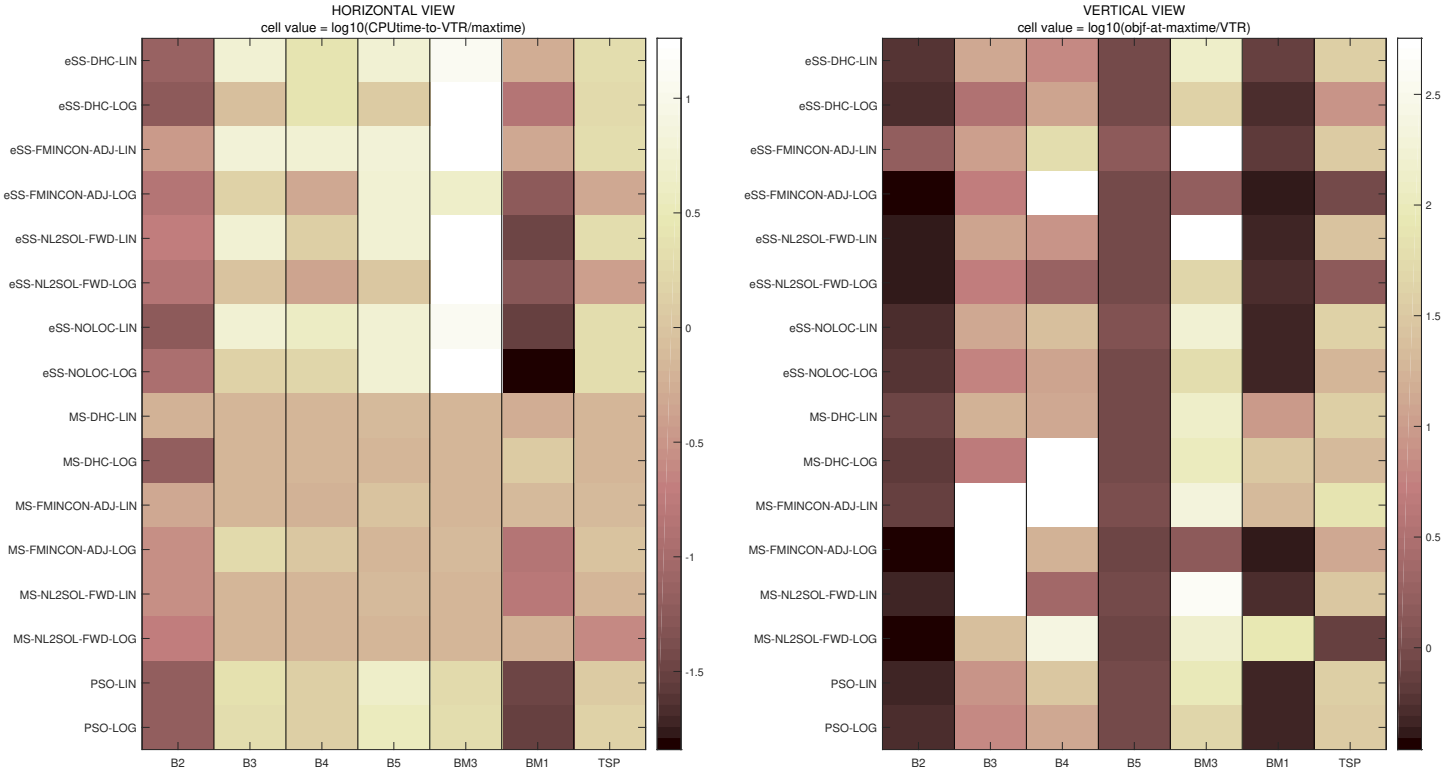

Figure S68: Result summary of horizontal and vertical views with VTR B, MAXT B in Table S1.

4.3.5 VTR C, MAXT A

Table S7: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR C; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.6969 ± 0.142	15044 ± 3760	475 ± 109	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	100
B2	eSS-NOLOC-LOG	0.9706 ± 0.02441	16394 ± 3562	455 ± 115	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.607 ± 0.2453	4427 ± 4154	1264 ± 1020	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	100
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.7906 ± 0.09586	11600 ± 0	391 ± 184	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	100
B2	MS-NL2SOL-FWD-LOG	0.391 ± 0.04693	293 ± 102	4185 ± 5170	0.3678 ± 0.02136	167 ± 196	9233 ± 725	80
B2	PSO-LOG	0.9815 ± 0.01836	9890 ± 7402	209 ± 144	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.4877 ± 0.2168	8593 ± 5844	2941 ± 2185	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	100
B2	eSS-DHC-LIN	0.7784 ± 0.1043	20783 ± 12365	426 ± 258	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	100
B2	eSS-NOLOC-LIN	0.974 ± 0.02495	16805 ± 3060	257 ± 45	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	100
B2	eSS-NL2SOL-FWD-LIN	0.575 ± 0.2418	10648 ± 9120	1131 ± 707	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	100
B2	MS-FMINCON-ADJ-LIN	0.5354 ± 0.1903	3912 ± 1812	6469 ± 5654	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	70
B2	MS-DHC-LIN	0.8834 ± 0.09135	11600 ± 0	897 ± 600	0.739 ± 0.04345	11420 ± 569	9889 ± 102	100
B2	MS-NL2SOL-FWD-LIN	0.5013 ± 0.06604	507 ± 544	2691 ± 3893	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	90
B2	PSO-LIN	0.9853 ± 0.03504	11650 ± 8944	248 ± 178	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	0.8902 ± 0.1273	97803 ± 73934	109360 ± 34836	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	40
B3	eSS-DHC-LOG	0.4723 ± 0.2991	54478 ± 22162	82473 ± 25986	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	70
B3	eSS-NOLOC-LOG	0.92 ± 0.07675	67529 ± 80429	126989 ± 24128	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	10
B3	eSS-NL2SOL-FWD-LOG	0.9225 ± 0.07541	83940 ± 86462	96492 ± 31391	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	60
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.731 ± 1.794	134498 ± 163481	647791 ± 144316	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.493 ± 1.722	816707 ± 1282676	534122 ± 142034	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.117 ± 1.682	738364 ± 1587201	572530 ± 113865	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.965 ± 1.883	155322 ± 211822	566398 ± 101024	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.62 ± 2.471	1126686 ± 394343	24451 ± 7907	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	10
B4	eSS-NOLOC-LOG	1.314 ± 0.993	845330 ± 498926	15882 ± 8911	3.766 ± 4.028	532986 ± 34062	9925 ± 74	40
B4	eSS-NL2SOL-FWD-LOG	0.532 ± 0.3447	161235 ± 244377	3725 ± 5598	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	80
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.346 ± 7.625	851338 ± 378267	53653 ± 7374	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.8565 ± 0.1453	1238503 ± 552992	20526 ± 10868	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	10
B4	eSS-NOLOC-LIN	1.033 ± 0.1175	1851036 ± 565829	28773 ± 8211	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.8062 ± 0.3222	572872 ± 440341	12310 ± 14194	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	50
B4	MS-FMINCON-ADJ-LIN	0.1871 ± 0.2823	4654 ± 5062	6851 ± 5740	3152 ± 8915	1360 ± 3299	4588 ± 3496	70
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.65 ± 70.25	468770 ± 470773	10386 ± 10501	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.889 ± 0.03808	2223 ± 99	1599 ± 478	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	100
B5	eSS-DHC-LOG	0.9126 ± 0.03815	9981 ± 1154	1791 ± 267	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	100
B5	eSS-NOLOC-LOG	0.9937 ± 0.006327	18278 ± 2910	3428 ± 883	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	100
B5	eSS-NL2SOL-FWD-LOG	0.9228 ± 0.03633	1843 ± 12	746 ± 161	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	100
B5	MS-FMINCON-ADJ-LOG	0.8723 ± 0.03072	575 ± 211	1613 ± 652	0.8535 ± 0.002632	486 ± 143	9351 ± 545	100
B5	MS-DHC-LOG	0.9116 ± 0.02632	7644 ± 1613	1130 ± 736	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	100
B5	MS-NL2SOL-FWD-LOG	0.932 ± 0.02711	69 ± 27	436 ± 435	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	100
B5	PSO-LOG	0.9972 ± 0.00302	6660 ± 2047	1003 ± 270	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	100
B5	eSS-FMINCON-ADJ-LIN	0.9259 ± 0.05271	7502 ± 6760	8761 ± 5529	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	70
B5	eSS-DHC-LIN	0.9576 ± 0.04938	53907 ± 64592	19594 ± 26611	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	70
B5	eSS-NOLOC-LIN	1.014 ± 0.01745	111560 ± 49485	39761 ± 23304	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	10
B5	eSS-NL2SOL-FWD-LIN	0.9335 ± 0.04978	21523 ± 43837	8909 ± 17502	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	90
B5	MS-FMINCON-ADJ-LIN	0.9306 ± 0.04726	811 ± 355	4620 ± 4341	0.938 ± 0.05679	93 ± 292	7879 ± 1757	80
B5	MS-DHC-LIN	0.9388 ± 0.0331	7790 ± 1452	2554 ± 2233	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	100
B5	MS-NL2SOL-FWD-LIN	0.927 ± 0.03404	141 ± 48	3423 ± 3246	0.9112 ± 0.04341	160 ± 155	9299 ± 417	90
B5	PSO-LIN	0.9983 ± 0.007468	16750 ± 25373	7170 ± 17747	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	90

Table S7 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR C; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.7568 ± 0.1552	267 ± 209	7 ± 6	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.7516 ± 0.1751	390 ± 197	12 ± 6	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	100
BM1	eSS-NOLOC-LOG	0.7174 ± 0.1316	348 ± 283	10 ± 8	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.7226 ± 0.1424	391 ± 196	12 ± 6	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.5242 ± 0.1607	26783 ± 13432	1180 ± 662	9.84 ± 27	6449 ± 8049	396 ± 345	40
BM1	MS-NL2SOL-FWD-LOG	0.4519 ± 0.03306	76 ± 30	589 ± 352	12.09 ± 36.8	44 ± 32	636 ± 266	90
BM1	PSO-LOG	0.7669 ± 0.13	375 ± 243	17 ± 7	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.6409 ± 0.1877	658 ± 530	209 ± 413	0.6322 ± 0.2762	736 ± 351	228 ± 235	90
BM1	eSS-DHC-LIN	0.6379 ± 0.1803	9719 ± 11127	244 ± 274	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	100
BM1	eSS-NOLOC-LIN	0.8072 ± 0.07596	553 ± 130	16 ± 3	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.7921 ± 0.1461	555 ± 355	20 ± 13	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.5625 ± 0.104	30608 ± 13383	757 ± 345	13.58 ± 27.47	24370 ± 16289	618 ± 347	80
BM1	MS-NL2SOL-FWD-LIN	0.5184 ± 0.1035	16 ± 5	98 ± 40	0.4566 ± 0.01809	9 ± 4	978 ± 14	100
BM1	PSO-LIN	0.8526 ± 0.1049	560 ± 486	16 ± 13	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	237699 ± 131144	398424 ± 202053	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9457 ± 0.3053	2653 ± 1344	68821 ± 42113	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	80
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.8247 ± 0.3107	12417 ± 31056	1487 ± 1947	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	91
MendesTSP	eSS-DHC-LOG	4.618 ± 5.697	106471 ± 24227	6878 ± 1579	6.107 ± 8.079	48384 ± 10824	3158 ± 716	10
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.511 ± 2.564	18705 ± 31477	1364 ± 2134	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	90
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1668 ± 1940	4829 ± 1696	104.1 ± 309.2	362 ± 318	2513 ± 1237	10
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	1595 ± 1010	0.7633 ± 0.2003	68 ± 172	3583 ± 13	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

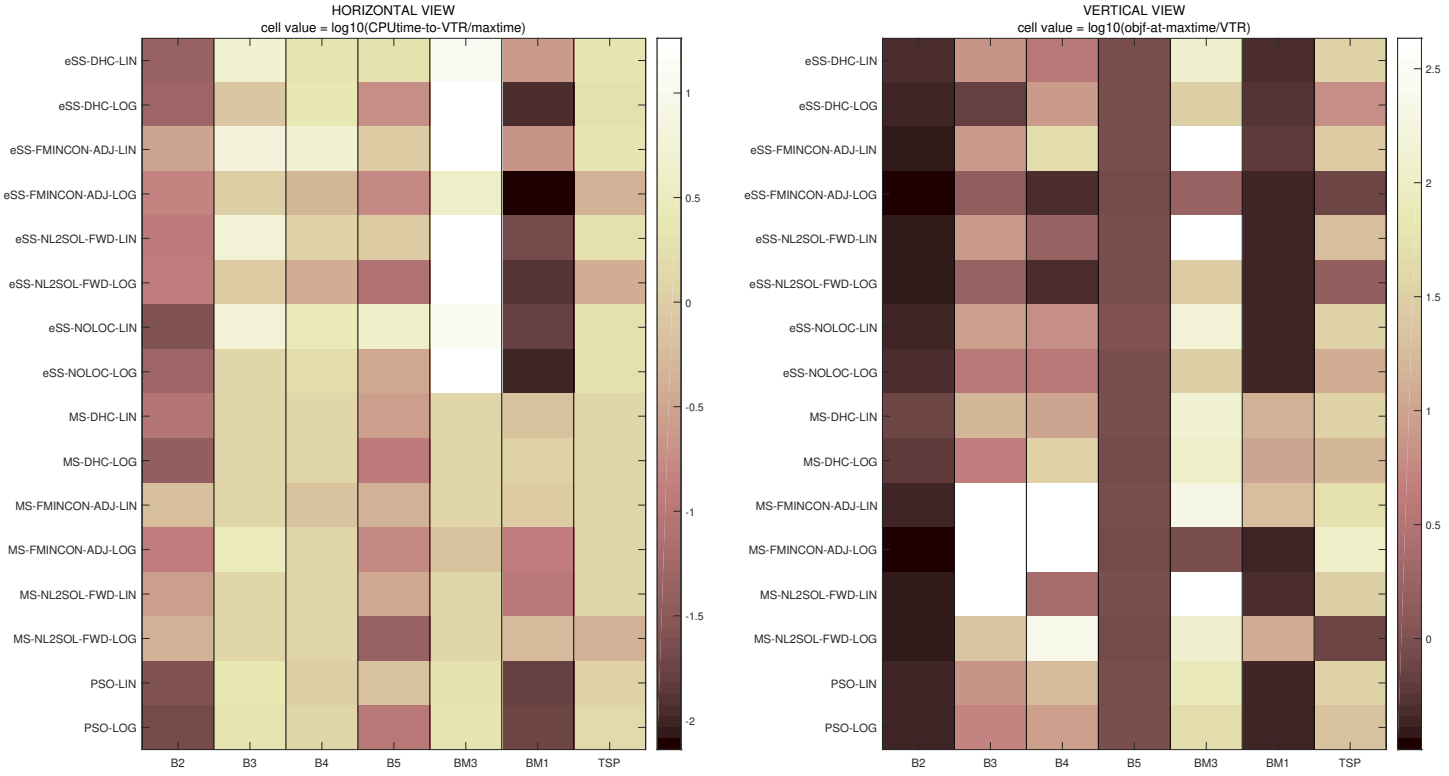

Figure S69: Result summary of horizontal and vertical views with VTR C, MAXT A in Table S1.

4.3.6 VTR C, MAXT B

Table S8: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR C; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.6969 ± 0.142	15044 ± 3760	475 ± 109	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	100
B2	eSS-NOLOC-LOG	0.9706 ± 0.02441	16394 ± 3562	455 ± 115	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.607 ± 0.2453	4427 ± 4154	1264 ± 1020	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	100
B2	MS-FMINCON-ADJ-LOG	0.3633 ± 0.07514	2311 ± 1181	2669 ± 3507	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	90
B2	MS-DHC-LOG	0.779 ± 0.0867	11600 ± 0	418 ± 208	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	100
B2	MS-NL2SOL-FWD-LOG	0.5055 ± 0.1848	203 ± 140	1663 ± 2017	0.3743 ± 0.01805	106 ± 157	4570 ± 438	90
B2	PSO-LOG	0.9815 ± 0.01836	9890 ± 7402	209 ± 144	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.4877 ± 0.2168	8593 ± 5844	2941 ± 2185	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	70
B2	eSS-DHC-LIN	0.7784 ± 0.1043	20783 ± 12365	426 ± 258	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	100
B2	eSS-NOLOC-LIN	0.974 ± 0.02495	16805 ± 3060	257 ± 45	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	100
B2	eSS-NL2SOL-FWD-LIN	0.575 ± 0.2418	10648 ± 9120	1131 ± 707	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	100
B2	MS-FMINCON-ADJ-LIN	0.4795 ± 0.205	4979 ± 1652	4766 ± 2404	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	60
B2	MS-DHC-LIN	0.8821 ± 0.07763	11600 ± 0	2152 ± 2711	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	80
B2	MS-NL2SOL-FWD-LIN	0.6133 ± 0.1674	533 ± 552	2563 ± 3043	0.4438 ± 0.04447	216 ± 468	4370 ± 804	80
B2	PSO-LIN	0.9853 ± 0.03504	11650 ± 8944	248 ± 178	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	0.8902 ± 0.1273	97803 ± 73934	109360 ± 34836	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.4723 ± 0.2991	54478 ± 22162	82473 ± 25986	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	10
B3	eSS-NOLOC-LOG	0.92 ± 0.07675	67529 ± 80429	126989 ± 24128	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.9225 ± 0.07541	83940 ± 86462	96492 ± 31391	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.731 ± 1.794	134498 ± 163481	647791 ± 144316	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.493 ± 1.722	816707 ± 1282676	534122 ± 142034	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.117 ± 1.682	738364 ± 1587201	572530 ± 113865	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.965 ± 1.883	155322 ± 211822	566398 ± 101024	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.62 ± 2.471	1126686 ± 394343	24451 ± 7907	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	1.314 ± 0.993	845330 ± 498926	15882 ± 8911	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.532 ± 0.3447	161235 ± 244377	3725 ± 5598	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	80
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3844 ± 5461	10130 ± 7468	16.71 ± 36.7	337 ± 692	2370 ± 1501	40
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.346 ± 7.625	851338 ± 378267	53653 ± 7374	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.8565 ± 0.1453	1238503 ± 552992	20526 ± 10868	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	1.033 ± 0.1175	1851036 ± 565829	28773 ± 8211	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.8062 ± 0.3222	572872 ± 440341	12310 ± 14194	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	40
B4	MS-FMINCON-ADJ-LIN	0.2125 ± 0.2626	4068 ± 5466	5455 ± 4410	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	60
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.65 ± 70.25	468770 ± 470773	10386 ± 10501	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.889 ± 0.03808	2223 ± 99	1599 ± 478	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	100
B5	eSS-DHC-LOG	0.9126 ± 0.03815	9981 ± 1154	1791 ± 267	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	100
B5	eSS-NOLOC-LOG	0.9937 ± 0.006327	18278 ± 2910	3428 ± 883	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	100
B5	eSS-NL2SOL-FWD-LOG	0.9228 ± 0.03633	1843 ± 12	746 ± 161	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	100
B5	MS-FMINCON-ADJ-LOG	0.8892 ± 0.03991	545 ± 178	1963 ± 1115	0.8561 ± 0.004511	546 ± 125	4322 ± 407	100
B5	MS-DHC-LOG	0.9295 ± 0.03872	5954 ± 2097	666 ± 266	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	100
B5	MS-NL2SOL-FWD-LOG	0.9081 ± 0.03749	79 ± 26	425 ± 193	0.8594 ± 0.004863	74 ± 26	4789 ± 180	100
B5	PSO-LOG	0.9972 ± 0.00302	6660 ± 2047	1003 ± 270	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	100
B5	eSS-FMINCON-ADJ-LIN	0.9259 ± 0.05271	7502 ± 6760	8761 ± 5529	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	35
B5	eSS-DHC-LIN	0.9576 ± 0.04938	53907 ± 64592	19594 ± 26611	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	60
B5	eSS-NOLOC-LIN	1.014 ± 0.01745	111560 ± 49485	39761 ± 23304	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9335 ± 0.04978	21523 ± 43837	8909 ± 17502	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	70
B5	MS-FMINCON-ADJ-LIN	0.9718 ± 0.07212	1057 ± 658	5256 ± 3704	1.012 ± 0.08305	1 ± 0	4066 ± 877	50
B5	MS-DHC-LIN	0.9275 ± 0.03365	8487 ± 358	3003 ± 1292	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	90
B5	MS-NL2SOL-FWD-LIN	0.9262 ± 0.02789	172 ± 52	2307 ± 1334	0.9161 ± 0.03134	168 ± 35	4416 ± 512	100
B5	PSO-LIN	0.9983 ± 0.007468	16750 ± 25373	7170 ± 17747	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	90

Table S8 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR C; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.7568 ± 0.1552	267 ± 209	7 ± 6	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	0.7516 ± 0.1751	390 ± 197	12 ± 6	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	100
BM1	eSS-NOLOC-LOG	0.7174 ± 0.1316	348 ± 283	10 ± 8	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	0.7226 ± 0.1424	391 ± 196	12 ± 6	0.5228 ± 0.0997	773 ± 741	176 ± 183	100
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	0.4871 ± 0.06421	26535 ± 13717	1171 ± 619	29.88 ± 60.84	3571 ± 4656	220 ± 188	30
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	68 ± 28	611 ± 342	85.38 ± 131.2	12 ± 21	126 ± 176	30
BM1	PSO-LOG	0.7669 ± 0.13	375 ± 243	17 ± 7	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	0.6409 ± 0.1877	658 ± 530	209 ± 413	0.6407 ± 0.2708	658 ± 294	160 ± 176	90
BM1	eSS-DHC-LIN	0.6379 ± 0.1803	9719 ± 11127	244 ± 274	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	80
BM1	eSS-NOLOC-LIN	0.8072 ± 0.07596	553 ± 130	16 ± 3	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	100
BM1	eSS-NL2SOL-FWD-LIN	0.7921 ± 0.1461	555 ± 355	20 ± 13	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.6087 ± 0.1042	22123 ± 15944	573 ± 446	9.56 ± 19.85	4233 ± 5527	133 ± 134	40
BM1	MS-NL2SOL-FWD-LIN	0.6184 ± 0.1347	14 ± 4	85 ± 43	0.4922 ± 0.07692	12 ± 6	479 ± 20	100
BM1	PSO-LIN	0.8526 ± 0.1049	560 ± 486	16 ± 13	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	237699 ± 131144	398424 ± 202053	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.056 ± 0.3641	2127 ± 1475	44348 ± 23257	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	50
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.8247 ± 0.3107	12417 ± 31056	1487 ± 1947	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	82
MendesTSP	eSS-DHC-LOG	4.618 ± 5.697	106471 ± 24227	6878 ± 1579	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.511 ± 2.564	18705 ± 31477	1364 ± 2134	1.518 ± 2.562	16140 ± 8294	1180 ± 556	80
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	2035 ± 2360	3237 ± 1607	12.85 ± 17.1	452 ± 388	1119 ± 499	10
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	902 ± 721	0.7633 ± 0.2003	72 ± 170	1785 ± 9	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

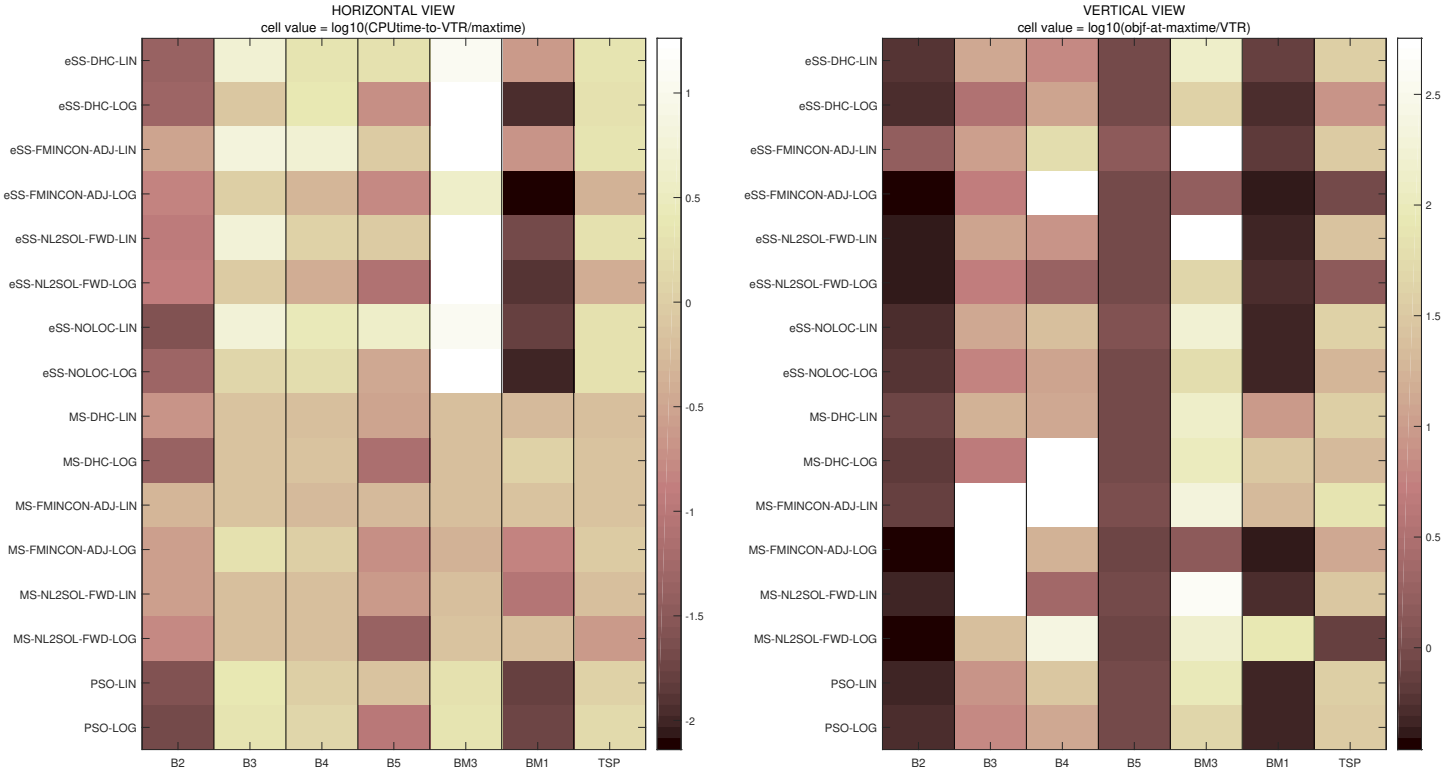

Figure S70: Result summary of horizontal and vertical views with VTR C, MAXT B in Table S1.

4.3.7 VTR D, MAXT A

Table S9: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR D; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.7155 ± 0.1891	13882 ± 396	442 ± 27	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	100
B2	eSS-NOLOC-LOG	1.34 ± 0.09633	8029 ± 2501	249 ± 69	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.667 ± 0.3604	3137 ± 1589	1227 ± 1056	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	100
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.8654 ± 0.1781	11600 ± 0	347 ± 176	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	100
B2	MS-NL2SOL-FWD-LOG	0.5158 ± 0.3922	283 ± 124	4152 ± 5198	0.3678 ± 0.02136	167 ± 196	9233 ± 725	80
B2	PSO-LOG	1.456 ± 0.03423	4100 ± 1914	97 ± 39	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.6106 ± 0.3874	6735 ± 2681	2408 ± 2114	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	100
B2	eSS-DHC-LIN	0.9654 ± 0.2968	13424 ± 1367	278 ± 31	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	100
B2	eSS-NOLOC-LIN	1.403 ± 0.05037	9195 ± 1465	149 ± 23	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	100
B2	eSS-NL2SOL-FWD-LIN	0.8736 ± 0.4768	9296 ± 7480	839 ± 696	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	100
B2	MS-FMINCON-ADJ-LIN	0.5588 ± 0.2426	3645 ± 2158	6234 ± 5879	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	70
B2	MS-DHC-LIN	0.9946 ± 0.1513	11600 ± 0	594 ± 601	0.739 ± 0.04345	11420 ± 569	9889 ± 102	100
B2	MS-NL2SOL-FWD-LIN	0.568 ± 0.2245	361 ± 430	2513 ± 3961	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	90
B2	PSO-LIN	1.364 ± 0.09159	5250 ± 1750	120 ± 35	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	1.462 ± 0.03216	48667 ± 18459	92809 ± 35541	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	80
B3	eSS-DHC-LOG	0.7443 ± 0.4638	36076 ± 17312	59959 ± 25397	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	90
B3	eSS-NOLOC-LOG	1.385 ± 0.1408	34874 ± 15466	118739 ± 21397	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	10
B3	eSS-NL2SOL-FWD-LOG	1.41 ± 0.09466	44237 ± 18502	91558 ± 29978	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	60
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.805 ± 1.681	88174 ± 40951	600494 ± 118515	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.593 ± 1.631	734988 ± 1301912	519920 ± 165051	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.166 ± 1.584	587130 ± 1551944	561363 ± 148889	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	4.063 ± 1.716	80591 ± 20672	560361 ± 114202	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.796 ± 2.262	1046701 ± 451133	22634 ± 9337	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	20
B4	eSS-NOLOC-LOG	1.747 ± 0.8388	730766 ± 445585	13610 ± 7599	3.766 ± 4.028	532986 ± 34062	9925 ± 74	40
B4	eSS-NL2SOL-FWD-LOG	0.6864 ± 0.5273	142623 ± 213904	3313 ± 4943	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	90
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.492 ± 7.513	768351 ± 312773	51376 ± 10489	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	1.107 ± 0.2935	1072267 ± 481194	17961 ± 10393	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	10
B4	eSS-NOLOC-LIN	1.475 ± 0.06493	1400804 ± 624559	21671 ± 8966	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.9611 ± 0.4027	538312 ± 430248	11680 ± 14230	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	60
B4	MS-FMINCON-ADJ-LIN	0.1871 ± 0.2823	4654 ± 5062	6851 ± 5740	3152 ± 8915	1360 ± 3299	4588 ± 3496	70
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.7 ± 70.22	433040 ± 437134	9536 ± 9565	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.9496 ± 0.1859	2170 ± 166	1449 ± 627	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	100
B5	eSS-DHC-LOG	0.9636 ± 0.1831	9489 ± 2708	1706 ± 492	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	100
B5	eSS-NOLOC-LOG	1.433 ± 0.06435	3415 ± 571	676 ± 186	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	100
B5	eSS-NL2SOL-FWD-LOG	1.034 ± 0.2213	1832 ± 26	682 ± 210	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	100
B5	MS-FMINCON-ADJ-LOG	1.06 ± 0.2178	240 ± 272	973 ± 471	0.8535 ± 0.002632	486 ± 143	9351 ± 545	100
B5	MS-DHC-LOG	1.207 ± 0.1594	659 ± 2083	361 ± 548	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	100
B5	MS-NL2SOL-FWD-LOG	0.9717 ± 0.07327	70 ± 27	321 ± 177	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	100
B5	PSO-LOG	1.437 ± 0.04541	1520 ± 339	253 ± 61	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	100
B5	eSS-FMINCON-ADJ-LIN	0.9642 ± 0.08385	3111 ± 508	5777 ± 2221	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	95
B5	eSS-DHC-LIN	1.007 ± 0.1055	9684 ± 1048	2400 ± 860	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	100
B5	eSS-NOLOC-LIN	1.435 ± 0.04748	5695 ± 1465	1642 ± 399	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	100
B5	eSS-NL2SOL-FWD-LIN	1.097 ± 0.2027	2436 ± 1846	1409 ± 510	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	100
B5	MS-FMINCON-ADJ-LIN	1.195 ± 0.2531	200 ± 339	690 ± 1221	0.938 ± 0.05679	93 ± 292	7879 ± 1757	100
B5	MS-DHC-LIN	1.299 ± 0.09664	0 ± 0	1 ± 0	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	100
B5	MS-NL2SOL-FWD-LIN	1.075 ± 0.1265	133 ± 52	1200 ± 767	0.9112 ± 0.04341	160 ± 155	9299 ± 417	100
B5	PSO-LIN	1.446 ± 0.02554	1820 ± 694	429 ± 170	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	100

Table S9 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR D; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.9115 ± 0.2579	145 ± 127	4 ± 4	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	1.021 ± 0.338	186 ± 171	6 ± 6	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	100
BM1	eSS-NOLOC-LOG	0.8472 ± 0.1956	228 ± 198	7 ± 6	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.8789 ± 0.2283	229 ± 196	8 ± 6	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.7122 ± 0.3912	19873 ± 14699	848 ± 617	9.84 ± 27	6449 ± 8049	396 ± 345	60
BM1	MS-NL2SOL-FWD-LOG	0.4519 ± 0.03306	76 ± 30	589 ± 352	12.09 ± 36.8	44 ± 32	636 ± 266	90
BM1	PSO-LOG	1.054 ± 0.3788	213 ± 99	12 ± 3	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.9515 ± 0.3057	349 ± 210	10 ± 6	0.6322 ± 0.2762	736 ± 351	228 ± 235	100
BM1	eSS-DHC-LIN	1.063 ± 0.259	308 ± 214	8 ± 5	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	100
BM1	eSS-NOLOC-LIN	1.055 ± 0.2502	350 ± 210	10 ± 6	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	1.141 ± 0.2278	148 ± 128	5 ± 4	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.5625 ± 0.104	30608 ± 13383	757 ± 345	13.58 ± 27.47	24370 ± 16289	618 ± 347	80
BM1	MS-NL2SOL-FWD-LIN	0.7519 ± 0.3958	13 ± 4	73 ± 36	0.4566 ± 0.01809	9 ± 4	978 ± 14	100
BM1	PSO-LIN	1.108 ± 0.2638	210 ± 129	6 ± 3	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.9868 ± 0.3387	46904 ± 60038	82416 ± 105278	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	67
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9457 ± 0.3053	2653 ± 1344	68821 ± 42113	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	80
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.932 ± 0.3593	11606 ± 31240	1340 ± 1964	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	91
MendesTSP	eSS-DHC-LOG	4.652 ± 5.674	104909 ± 29064	6785 ± 1871	6.107 ± 8.079	48384 ± 10824	3158 ± 716	10
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.631 ± 2.532	15902 ± 31803	1148 ± 2150	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	90
MendesTSP	MS-FMINCON-ADJ-LOG	2.743 ± 2.933	2241 ± 2226	4282 ± 1962	104.1 ± 309.2	362 ± 318	2513 ± 1237	20
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	1.207 ± 0.267	130 ± 2	548 ± 441	0.7633 ± 0.2003	68 ± 172	3583 ± 13	100
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

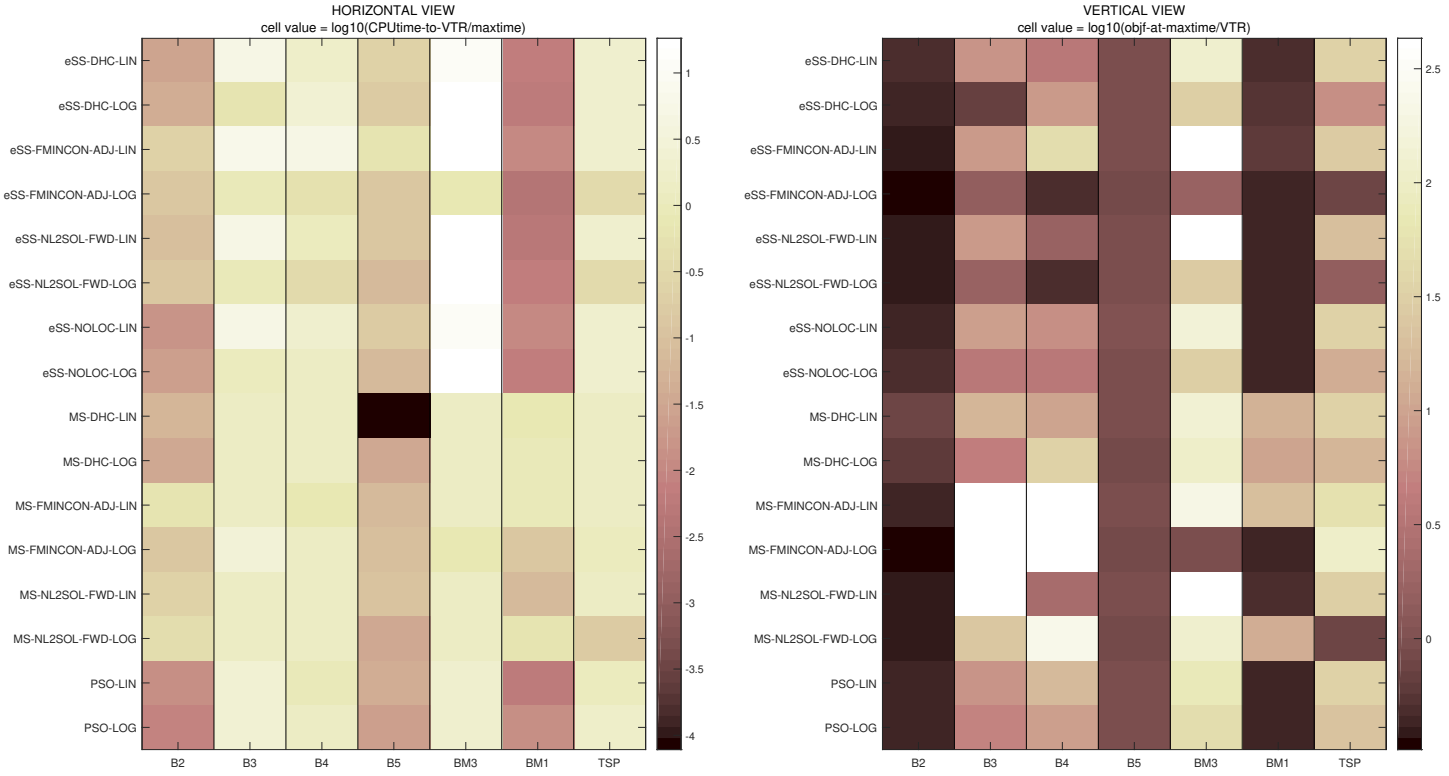

Figure S71: Result summary of horizontal and vertical views with VTR D, MAXT A in Table S1.

4.3.8 VTR D, MAXT B

Table S10: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR D; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.7155 ± 0.1891	13882 ± 396	442 ± 27	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	100
B2	eSS-NOLOC-LOG	1.34 ± 0.09633	8029 ± 2501	249 ± 69	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.667 ± 0.3604	3137 ± 1589	1227 ± 1056	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	100
B2	MS-FMINCON-ADJ-LOG	0.3633 ± 0.07514	2311 ± 1181	2669 ± 3507	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	90
B2	MS-DHC-LOG	0.9226 ± 0.2786	11308 ± 616	314 ± 101	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	100
B2	MS-NL2SOL-FWD-LOG	0.5055 ± 0.1848	203 ± 140	1663 ± 2017	0.3743 ± 0.01805	106 ± 157	4570 ± 438	90
B2	PSO-LOG	1.456 ± 0.03423	4100 ± 1914	97 ± 39	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.6106 ± 0.3874	6735 ± 2681	2408 ± 2114	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	80
B2	eSS-DHC-LIN	0.9654 ± 0.2968	13424 ± 1367	278 ± 31	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	100
B2	eSS-NOLOC-LIN	1.403 ± 0.05037	9195 ± 1465	149 ± 23	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	100
B2	eSS-NL2SOL-FWD-LIN	0.8736 ± 0.4768	9296 ± 7480	839 ± 696	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	100
B2	MS-FMINCON-ADJ-LIN	0.5 ± 0.2532	4712 ± 2176	4531 ± 2735	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	60
B2	MS-DHC-LIN	0.9171 ± 0.09758	11600 ± 0	1767 ± 2719	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	80
B2	MS-NL2SOL-FWD-LIN	0.6133 ± 0.1674	533 ± 552	2563 ± 3043	0.4438 ± 0.04447	216 ± 468	4370 ± 804	80
B2	PSO-LIN	1.364 ± 0.09159	5250 ± 1750	120 ± 35	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	1.462 ± 0.03216	48667 ± 18459	92809 ± 35541	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	10
B3	eSS-DHC-LOG	0.7443 ± 0.4638	36076 ± 17312	59959 ± 25397	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	40
B3	eSS-NOLOC-LOG	1.385 ± 0.1408	34874 ± 15466	118739 ± 21397	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	1.41 ± 0.09466	44237 ± 18502	91558 ± 29978	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.805 ± 1.681	88174 ± 40951	600494 ± 118515	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.593 ± 1.631	734988 ± 1301912	519920 ± 165051	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.166 ± 1.584	587130 ± 1551944	561363 ± 148889	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	4.063 ± 1.716	80591 ± 20672	560361 ± 114202	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.796 ± 2.262	1046701 ± 451133	22634 ± 9337	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	1.747 ± 0.8388	730766 ± 445585	13610 ± 7599	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.6864 ± 0.5273	142623 ± 213904	3313 ± 4943	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	80
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3844 ± 5461	10130 ± 7468	16.71 ± 36.7	337 ± 692	2370 ± 1501	40
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.492 ± 7.513	768351 ± 312773	51376 ± 10489	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	1.107 ± 0.2935	1072267 ± 481194	17961 ± 10393	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	10
B4	eSS-NOLOC-LIN	1.475 ± 0.06493	1400804 ± 624559	21671 ± 8966	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.9611 ± 0.4027	538312 ± 430248	11680 ± 14230	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	40
B4	MS-FMINCON-ADJ-LIN	0.2125 ± 0.2626	4068 ± 5466	5455 ± 4410	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	60
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.7 ± 70.22	433040 ± 437134	9536 ± 9565	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.9496 ± 0.1859	2170 ± 166	1449 ± 627	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	100
B5	eSS-DHC-LOG	0.9636 ± 0.1831	9489 ± 2708	1706 ± 492	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	100
B5	eSS-NOLOC-LOG	1.433 ± 0.06435	3415 ± 571	676 ± 186	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	100
B5	eSS-NL2SOL-FWD-LOG	1.034 ± 0.2213	1832 ± 26	682 ± 210	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	100
B5	MS-FMINCON-ADJ-LOG	1.139 ± 0.2221	219 ± 285	1097 ± 690	0.8561 ± 0.004511	546 ± 125	4322 ± 407	100
B5	MS-DHC-LOG	1.234 ± 0.1444	860 ± 2720	262 ± 235	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	100
B5	MS-NL2SOL-FWD-LOG	0.944 ± 0.08053	82 ± 25	368 ± 118	0.8594 ± 0.004863	74 ± 26	4789 ± 180	100
B5	PSO-LOG	1.437 ± 0.04541	1520 ± 339	253 ± 61	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	100
B5	eSS-FMINCON-ADJ-LIN	0.9642 ± 0.08385	3111 ± 508	5777 ± 2221	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	40
B5	eSS-DHC-LIN	1.007 ± 0.1055	9684 ± 1048	2400 ± 860	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	100
B5	eSS-NOLOC-LIN	1.435 ± 0.04748	5695 ± 1465	1642 ± 399	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	100
B5	eSS-NL2SOL-FWD-LIN	1.097 ± 0.2027	2436 ± 1846	1409 ± 510	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	100
B5	MS-FMINCON-ADJ-LIN	1.243 ± 0.1673	102 ± 322	266 ± 835	1.012 ± 0.08305	1 ± 0	4066 ± 877	100
B5	MS-DHC-LIN	1.298 ± 0.1054	0 ± 0	1 ± 0	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	100
B5	MS-NL2SOL-FWD-LIN	1.028 ± 0.1223	175 ± 145	935 ± 638	0.9161 ± 0.03134	168 ± 35	4416 ± 512	100
B5	PSO-LIN	1.446 ± 0.02554	1820 ± 694	429 ± 170	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	100

Table S10 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR D; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.439 ± 0.02085	844 ± 283	138 ± 121	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.4533 ± 0.0176	18196 ± 15037	548 ± 443	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	70
BM1	eSS-NOLOC-LOG	0.4776 ± 0.01775	1586 ± 325	44 ± 10	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.4436 ± 0.01186	577 ± 38	445 ± 266	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.4701 ± 0.03855	26722 ± 13127	1350 ± 535	9.84 ± 27	6449 ± 8049	396 ± 345	30
BM1	MS-NL2SOL-FWD-LOG	0.4451 ± 0.01311	75 ± 31	708 ± 423	12.09 ± 36.8	44 ± 32	636 ± 266	80
BM1	PSO-LOG	0.4853 ± 0.01202	1850 ± 583	62 ± 18	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.4388 ± 0.00624	1344 ± 538	749 ± 509	0.6322 ± 0.2762	736 ± 351	228 ± 235	60
BM1	eSS-DHC-LIN	0.4608 ± 0.02213	27534 ± 15526	686 ± 360	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	90
BM1	eSS-NOLOC-LIN	0.4862 ± 0.009987	4552 ± 1950	122 ± 49	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.4707 ± 0.02068	3307 ± 2225	139 ± 86	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.4878 ± 0.04507	30436 ± 12290	1316 ± 668	13.58 ± 27.47	24370 ± 16289	618 ± 347	30
BM1	MS-NL2SOL-FWD-LIN	0.4581 ± 0.01452	16 ± 5	263 ± 346	0.4566 ± 0.01809	9 ± 4	978 ± 14	90
BM1	PSO-LIN	0.4939 ± 0.007017	7230 ± 5197	186 ± 130	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	385922 ± 12076	608242 ± 1129	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	2759 ± 1398	137709 ± 6525	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	0
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	64719 ± 22468	7363 ± 154	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	0
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	100419 ± 5319	7216 ± 6	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	0
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1599 ± 1981	5251 ± 825	104.1 ± 309.2	362 ± 318	2513 ± 1237	0
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

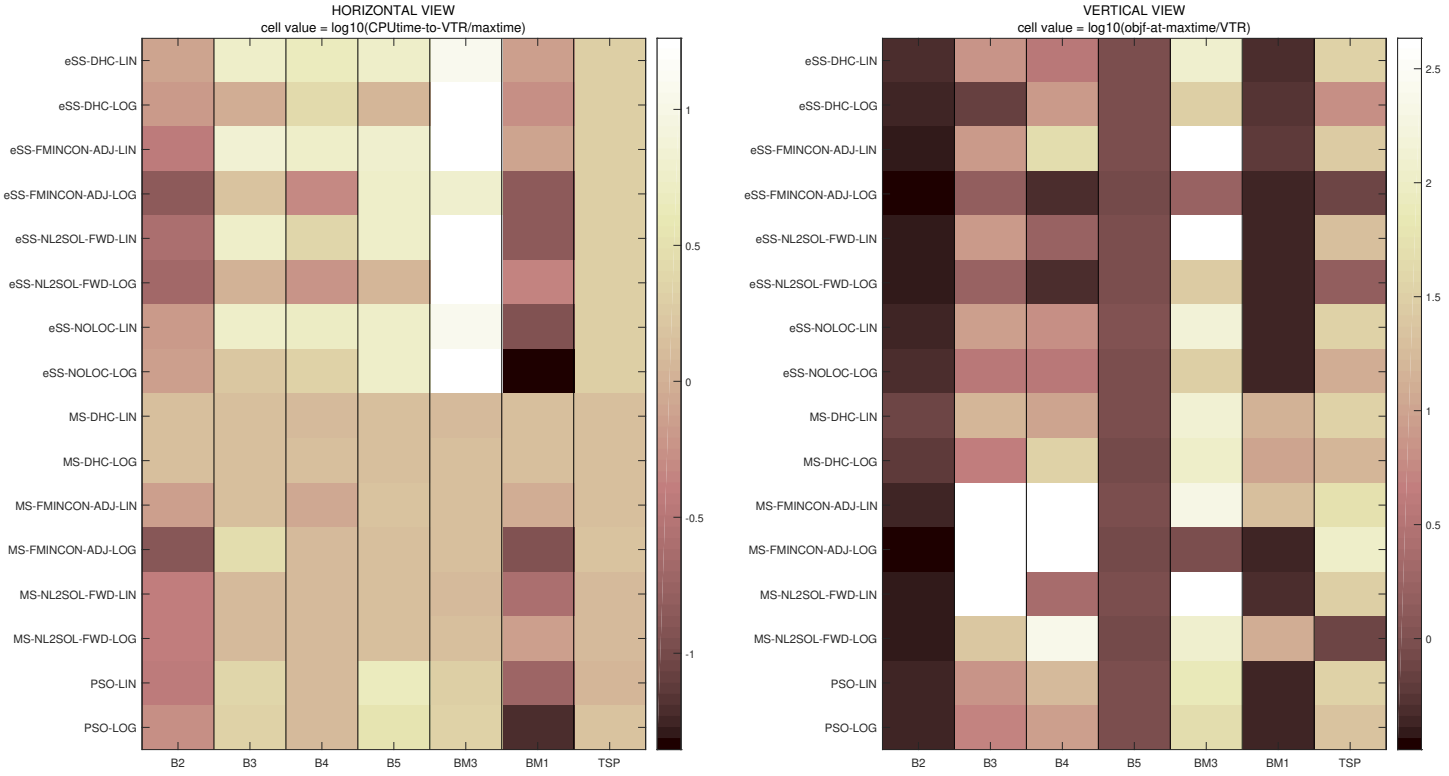

Figure S72: Result summary of horizontal and vertical views with VTR A, MAXT A in Table S1.

4.3.9 VTR E, MAXT A

Table S11: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR E; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	140574 ± 46511	14193 ± 2721	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	10
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	0
B2	MS-FMINCON-ADJ-LOG	0.3234 ± 0.01017	2478 ± 941	13686 ± 2644	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	10
B2	MS-DHC-LOG	0.5977 ± 0.02913	11600 ± 0	13146 ± 75	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	0
B2	MS-NL2SOL-FWD-LOG	0.3597 ± 0.02073	223 ± 94	13828 ± 600	0.3678 ± 0.02136	167 ± 196	9233 ± 725	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	0
B2	MS-FMINCON-ADJ-LIN	0.3617 ± 0.02682	5308 ± 1183	14927 ± 1062	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	0
B2	MS-DHC-LIN	0.7281 ± 0.03608	10297 ± 3533	13112 ± 89	0.739 ± 0.04345	11420 ± 569	9889 ± 102	0
B2	MS-NL2SOL-FWD-LIN	0.3992 ± 0.01643	666 ± 613	13612 ± 805	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.08348 ± 0.01574	1039044 ± 540138	627542 ± 54326	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	0
B3	eSS-DHC-LOG	0.06656 ± 0.00221	3323145 ± 1329605	583057 ± 60563	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	0
B3	eSS-NOLOC-LOG	0.1213 ± 0.1625	1856509 ± 296304	432490 ± 1085	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	0
B3	eSS-NL2SOL-FWD-LOG	0.06616 ± 0.001276	4113388 ± 869564	570989 ± 47644	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	0
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.233 ± 2.006	1334894 ± 1586011	611885 ± 7382	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.781 ± 2.216	567957 ± 1041335	612341 ± 8534	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.06092 ± 0.0003487	173575 ± 114787	27329 ± 8272	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	0
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	3.766 ± 4.028	532986 ± 34062	9925 ± 74	0
B4	eSS-NL2SOL-FWD-LOG	0.1856 ± 0.1877	1301483 ± 263873	28814 ± 7	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	0
B4	MS-FMINCON-ADJ-LOG	0.5692 ± 1.11	5094 ± 6849	17414 ± 2547	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	0
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	0
B4	MS-FMINCON-ADJ-LIN	0.06533 ± 0.006233	7311 ± 5190	15735 ± 2794	3152 ± 8915	1360 ± 3299	4588 ± 3496	0
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	0
B5	MS-FMINCON-ADJ-LOG	0.853 ± 0.002345	478 ± 180	13633 ± 411	0.8535 ± 0.002632	486 ± 143	9351 ± 545	0
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8562 ± 0.001112	131 ± 150	13135 ± 126	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1254 ± 146	13361 ± 3835	0.938 ± 0.05679	93 ± 292	7879 ± 1757	10
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	0

Table S11 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks BM1, BM3, and TSP. For the horizontal view, the stopping criterion is VTR E; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4188 ± 0.0001661	772997 ± 390438	40249 ± 20244	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	0
BM1	eSS-DHC-LOG	0.4266 ± 0.001536	1015580 ± 11481	31740 ± 2885	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	0
BM1	eSS-NOLOC-LOG	0.4271 ± 0.0007037	503053 ± 55042	14405 ± 4	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	0
BM1	eSS-NL2SOL-FWD-LOG	0.4249 ± 0.002759	465237 ± 110598	31849 ± 9201	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	0
BM1	MS-FMINCON-ADJ-LOG	0.4196 ± 0.0008062	960 ± 475	1376 ± 251	0.4207 ± 0.002796	434 ± 500	869 ± 134	10
BM1	MS-DHC-LOG	0.4679 ± 0.03952	27075 ± 12632	1582 ± 239	9.84 ± 27	6449 ± 8049	396 ± 345	0
BM1	MS-NL2SOL-FWD-LOG	0.4342 ± 0.01445	84 ± 35	1555 ± 234	12.09 ± 36.8	44 ± 32	636 ± 266	0
BM1	PSO-LOG	0.4359 ± 0.008588	23863 ± 16860	667 ± 441	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	0
BM1	eSS-FMINCON-ADJ-LIN	0.422 ± 0.006212	272978 ± 30755	65469 ± 1815	0.6322 ± 0.2762	736 ± 351	228 ± 235	0
BM1	eSS-DHC-LIN	0.4327 ± 0.008251	1022240 ± 22238	24484 ± 1496	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	0
BM1	eSS-NOLOC-LIN	0.4274 ± 0.00199	1000180 ± 141	27232 ± 2793	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	0
BM1	eSS-NL2SOL-FWD-LIN	0.4224 ± 0.002813	1784399 ± 319485	64825 ± 20	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	0
BM1	MS-FMINCON-ADJ-LIN	0.4318 ± 0.007252	1894 ± 1390	2040 ± 751	20.34 ± 49.97	322 ± 322	441 ± 433	0
BM1	MS-DHC-LIN	0.4852 ± 0.046	31775 ± 11366	1760 ± 279	13.58 ± 27.47	24370 ± 16289	618 ± 347	0
BM1	MS-NL2SOL-FWD-LIN	0.4505 ± 0.001743	11 ± 4	1325 ± 16	0.4566 ± 0.01809	9 ± 4	978 ± 14	0
BM1	PSO-LIN	0.4419 ± 0.009461	40210 ± 27097	1037 ± 756	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	0
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	3105 ± 1011	98933 ± 40060	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	50
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	36162 ± 41095	3749 ± 2840	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	64
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	80
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1599 ± 1981	5251 ± 825	104.1 ± 309.2	362 ± 318	2513 ± 1237	0
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

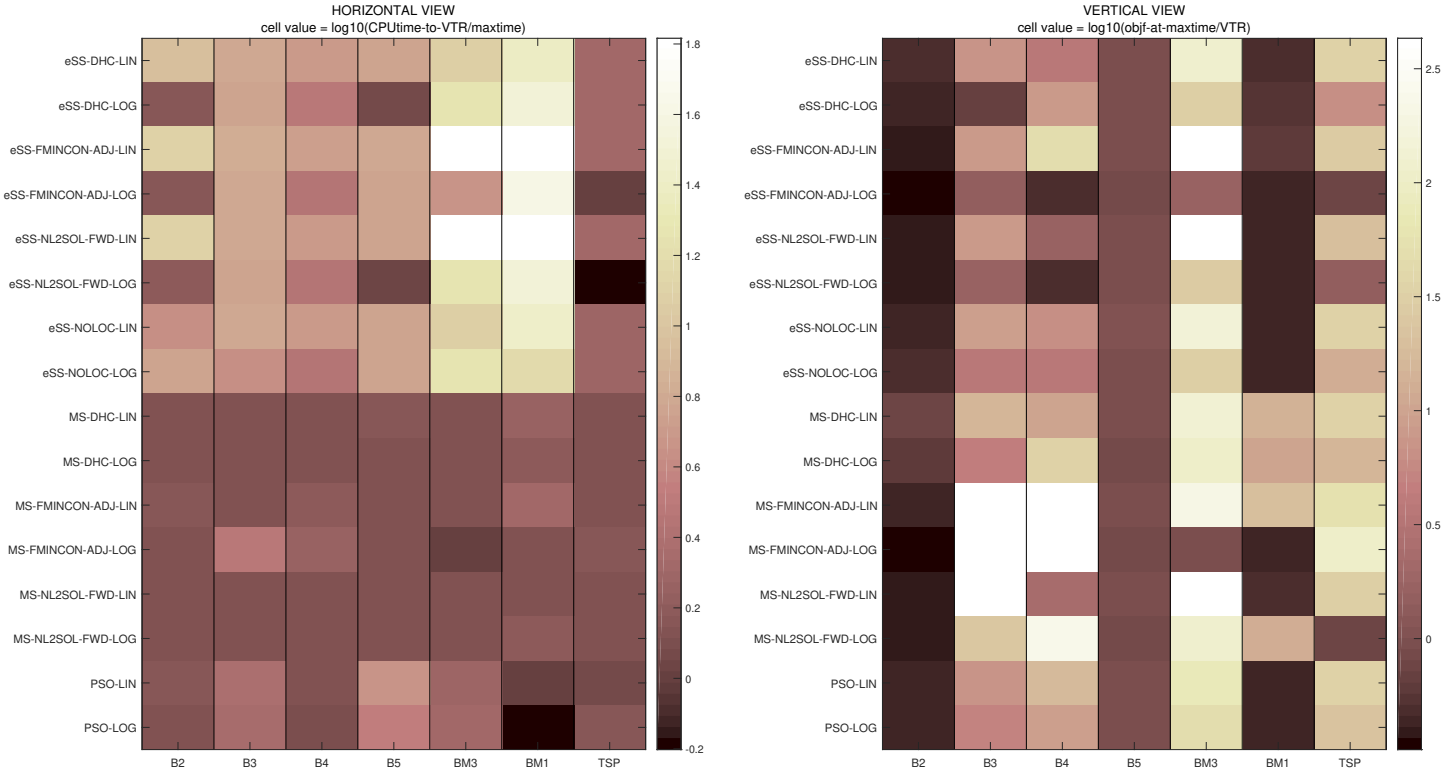

Figure S73: Result summary of horizontal and vertical views with VTR E, MAXT A in Table S1.

4.3.10 VTR E, MAXT B

Table S12: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR E; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	140574 ± 46511	14193 ± 2721	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	0
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	0
B2	MS-FMINCON-ADJ-LOG	0.3345 ± 0.01745	2177 ± 1158	7752 ± 1639	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	0
B2	MS-DHC-LOG	0.6185 ± 0.03374	11567 ± 104	6626 ± 86	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	0
B2	MS-NL2SOL-FWD-LOG	0.3685 ± 0.01925	293 ± 111	7526 ± 589	0.3743 ± 0.01805	106 ± 157	4570 ± 438	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	0
B2	MS-FMINCON-ADJ-LIN	0.4077 ± 0.1287	4904 ± 1148	8183 ± 1047	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	0
B2	MS-DHC-LIN	0.7796 ± 0.04802	11600 ± 0	6704 ± 114	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	0
B2	MS-NL2SOL-FWD-LIN	0.4218 ± 0.02543	580 ± 530	7975 ± 1589	0.4438 ± 0.04447	216 ± 468	4370 ± 804	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.08348 ± 0.01574	1039044 ± 540138	627542 ± 54326	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.06656 ± 0.00221	3323145 ± 1329605	583057 ± 60563	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	0
B3	eSS-NOLOC-LOG	0.1213 ± 0.1625	1856509 ± 296304	432490 ± 1085	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.06616 ± 0.001276	4113388 ± 869564	570989 ± 47644	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.233 ± 2.006	1334894 ± 1586011	611885 ± 7382	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.781 ± 2.216	567957 ± 1041335	612341 ± 8534	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.06092 ± 0.0003487	173575 ± 114787	27329 ± 8272	2799 ± 6064	9828 ± 7412	2217 ± 1677	0
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.1856 ± 0.1877	1301483 ± 263873	28814 ± 7	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	0
B4	MS-FMINCON-ADJ-LOG	0.2498 ± 0.3917	3378 ± 5707	11853 ± 5752	16.71 ± 36.7	337 ± 692	2370 ± 1501	0
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	0
B4	MS-FMINCON-ADJ-LIN	0.1618 ± 0.271	7915 ± 4977	11644 ± 2883	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	0
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	0
B5	MS-FMINCON-ADJ-LOG	0.8542 ± 0.003445	603 ± 159	7089 ± 497	0.8561 ± 0.004511	546 ± 125	4322 ± 407	0
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8567 ± 0.001715	90 ± 25	6711 ± 95	0.8594 ± 0.004863	74 ± 26	4789 ± 180	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S12 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR E; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4188 ± 0.0001661	772997 ± 390438	40249 ± 20244	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	0
BM1	eSS-DHC-LOG	0.4266 ± 0.001536	1015580 ± 11481	31740 ± 2885	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	0
BM1	eSS-NOLOC-LOG	0.4271 ± 0.0007037	503053 ± 55042	14405 ± 4	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	0
BM1	eSS-NL2SOL-FWD-LOG	0.4249 ± 0.002759	465237 ± 110598	31849 ± 9201	0.5228 ± 0.0997	773 ± 741	176 ± 183	0
BM1	MS-FMINCON-ADJ-LOG	0.4196 ± 0.0007138	902 ± 507	842 ± 150	0.4217 ± 0.003815	370 ± 237	381 ± 92	0
BM1	MS-DHC-LOG	0.4675 ± 0.03976	30568 ± 10770	1510 ± 517	29.88 ± 60.84	3571 ± 4656	220 ± 188	0
BM1	MS-NL2SOL-FWD-LOG	0.4438 ± 0.03561	85 ± 41	1096 ± 427	85.38 ± 131.2	12 ± 21	126 ± 176	0
BM1	PSO-LOG	0.4359 ± 0.008588	23863 ± 16860	667 ± 441	0.4424 ± 0.006082	16450 ± 794	499 ± 1	0
BM1	eSS-FMINCON-ADJ-LIN	0.422 ± 0.006212	272978 ± 30755	65469 ± 1815	0.6407 ± 0.2708	658 ± 294	160 ± 176	0
BM1	eSS-DHC-LIN	0.4327 ± 0.008251	1022240 ± 22238	24484 ± 1496	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	0
BM1	eSS-NOLOC-LIN	0.4274 ± 0.00199	1000180 ± 141	27232 ± 2793	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	0
BM1	eSS-NL2SOL-FWD-LIN	0.4224 ± 0.002813	1784399 ± 319485	64825 ± 20	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	0
BM1	MS-FMINCON-ADJ-LIN	0.4328 ± 0.006424	1682 ± 1007	1316 ± 629	21.52 ± 49.73	300 ± 293	182 ± 182	0
BM1	MS-DHC-LIN	0.5171 ± 0.06441	37066 ± 3903	1180 ± 255	9.56 ± 19.85	4233 ± 5527	133 ± 134	0
BM1	MS-NL2SOL-FWD-LIN	0.4657 ± 0.02369	13 ± 6	664 ± 11	0.4922 ± 0.07692	12 ± 6	479 ± 20	0
BM1	PSO-LIN	0.4419 ± 0.009461	40210 ± 27097	1037 ± 756	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	0
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.019 ± 0.3833	2912 ± 1081	65694 ± 11449	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	10
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	36162 ± 41095	3749 ± 2840	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	27
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.518 ± 2.562	16140 ± 8294	1180 ± 556	60
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	1969 ± 2403	3440 ± 1342	12.85 ± 17.1	452 ± 388	1119 ± 499	0
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	326 ± 241	2356 ± 13	0.7633 ± 0.2003	72 ± 170	1785 ± 9	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

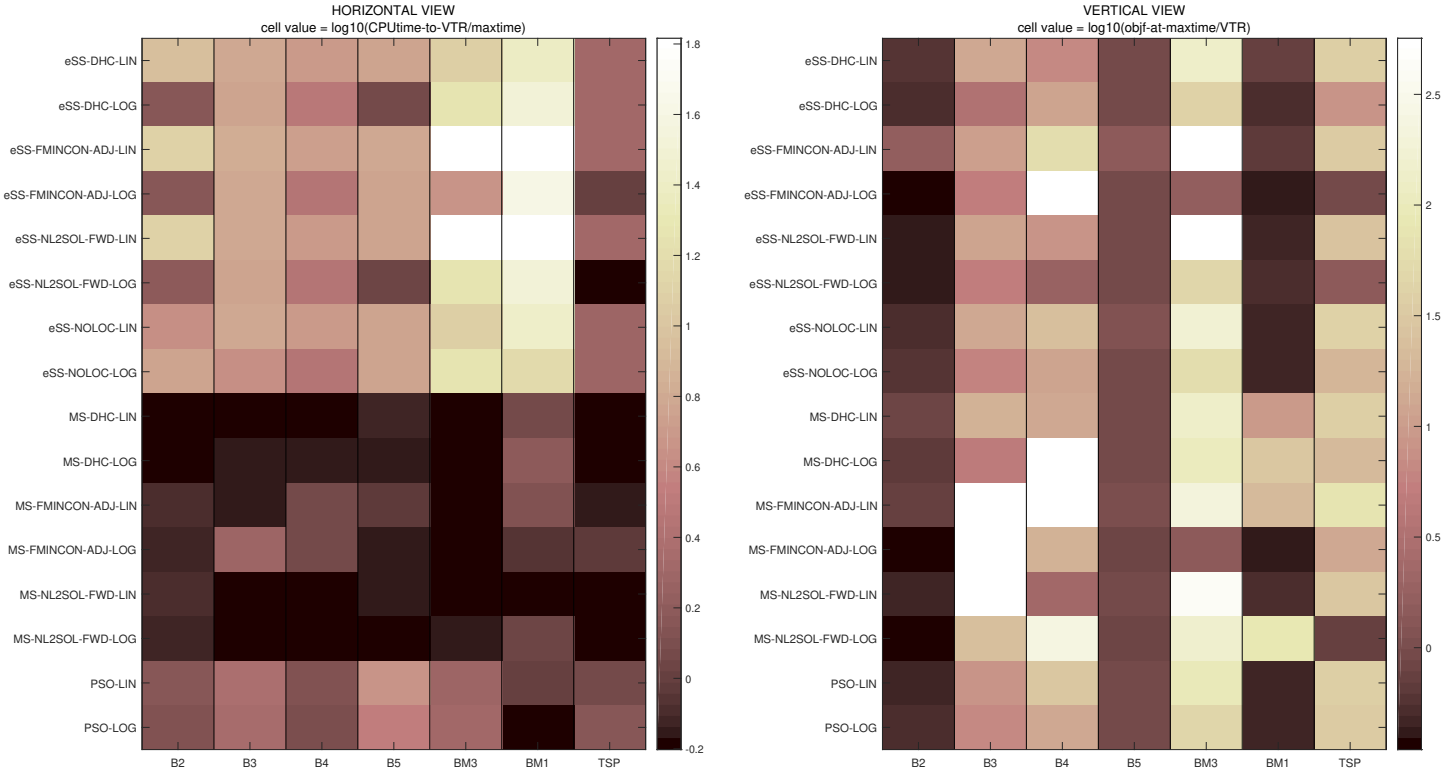

Figure S74: Result summary of horizontal and vertical views with VTR E, MAXT B in Table S1.

4.3.11 VTR F, MAXT A

Table S13: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR F; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	140574 ± 46511	14193 ± 2721	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	10
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	0
B2	MS-FMINCON-ADJ-LOG	0.3234 ± 0.01017	2478 ± 941	13686 ± 2644	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	10
B2	MS-DHC-LOG	0.5977 ± 0.02913	11600 ± 0	13146 ± 75	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	0
B2	MS-NL2SOL-FWD-LOG	0.3597 ± 0.02073	223 ± 94	13828 ± 600	0.3678 ± 0.02136	167 ± 196	9233 ± 725	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	0
B2	MS-FMINCON-ADJ-LIN	0.3617 ± 0.02682	5308 ± 1183	14927 ± 1062	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	0
B2	MS-DHC-LIN	0.7281 ± 0.03608	10297 ± 3533	13112 ± 89	0.739 ± 0.04345	11420 ± 569	9889 ± 102	0
B2	MS-NL2SOL-FWD-LIN	0.3992 ± 0.01643	666 ± 613	13612 ± 805	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.08348 ± 0.01574	1039044 ± 540138	627542 ± 54326	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	0
B3	eSS-DHC-LOG	0.0688 ± 0.0008946	1465283 ± 1039299	328033 ± 182064	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	0
B3	eSS-NOLOC-LOG	0.1221 ± 0.1622	1588823 ± 512679	385156 ± 69986	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	0
B3	eSS-NL2SOL-FWD-LOG	0.06856 ± 3.348e-06	2307518 ± 1087778	358169 ± 113708	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	0
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.233 ± 2.006	1202648 ± 1444899	596921 ± 50183	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.781 ± 2.216	567957 ± 1041335	612341 ± 8534	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.06154 ± 0.0005754	29801 ± 16354	7419 ± 3732	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	70
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	3.766 ± 4.028	532986 ± 34062	9925 ± 74	0
B4	eSS-NL2SOL-FWD-LOG	0.1856 ± 0.1877	1301483 ± 263873	28814 ± 7	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	0
B4	MS-FMINCON-ADJ-LOG	0.5692 ± 1.11	5094 ± 6849	17414 ± 2547	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	0
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	0
B4	MS-FMINCON-ADJ-LIN	0.06533 ± 0.006233	7311 ± 5190	15735 ± 2794	3152 ± 8915	1360 ± 3299	4588 ± 3496	0
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	0
B5	MS-FMINCON-ADJ-LOG	0.853 ± 0.002345	478 ± 180	13633 ± 411	0.8535 ± 0.002632	486 ± 143	9351 ± 545	0
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8562 ± 0.001112	131 ± 150	13135 ± 126	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1254 ± 146	13361 ± 3835	0.938 ± 0.05679	93 ± 292	7879 ± 1757	10
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	0

Table S13 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR F; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4201 ± 0.0008123	17230 ± 17442	1115 ± 810	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	60
BM1	eSS-DHC-LOG	0.4266 ± 0.001536	1015580 ± 11481	31740 ± 2885	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	0
BM1	eSS-NOLOC-LOG	0.4271 ± 0.0007037	503053 ± 55042	14405 ± 4	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	0
BM1	eSS-NL2SOL-FWD-LOG	0.425 ± 0.002482	456174 ± 139256	30062 ± 11397	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	0
BM1	MS-FMINCON-ADJ-LOG	0.4205 ± 0.0007232	1045 ± 321	540 ± 263	0.4207 ± 0.002796	434 ± 500	869 ± 134	90
BM1	MS-DHC-LOG	0.4679 ± 0.03952	27075 ± 12632	1582 ± 239	9.84 ± 27	6449 ± 8049	396 ± 345	0
BM1	MS-NL2SOL-FWD-LOG	0.4342 ± 0.01445	84 ± 35	1555 ± 234	12.09 ± 36.8	44 ± 32	636 ± 266	0
BM1	PSO-LOG	0.4359 ± 0.008588	23863 ± 16860	667 ± 441	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	0
BM1	eSS-FMINCON-ADJ-LIN	0.4222 ± 0.006128	200608 ± 105567	47971 ± 23582	0.6322 ± 0.2762	736 ± 351	228 ± 235	0
BM1	eSS-DHC-LIN	0.4327 ± 0.008184	1019682 ± 25918	24401 ± 1436	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	0
BM1	eSS-NOLOC-LIN	0.4274 ± 0.00199	1000180 ± 141	27232 ± 2793	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	0
BM1	eSS-NL2SOL-FWD-LIN	0.4233 ± 0.001766	1537120 ± 524239	54695 ± 13286	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	0
BM1	MS-FMINCON-ADJ-LIN	0.4318 ± 0.007252	1894 ± 1390	2040 ± 751	20.34 ± 49.97	322 ± 322	441 ± 433	0
BM1	MS-DHC-LIN	0.4852 ± 0.046	31775 ± 11366	1760 ± 279	13.58 ± 27.47	24370 ± 16289	618 ± 347	0
BM1	MS-NL2SOL-FWD-LIN	0.4505 ± 0.001743	11 ± 4	1325 ± 16	0.4566 ± 0.01809	9 ± 4	978 ± 14	0
BM1	PSO-LIN	0.4419 ± 0.009461	40210 ± 27097	1037 ± 756	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	0
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	3105 ± 1011	98933 ± 40060	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	50
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	36162 ± 41095	3749 ± 2840	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	64
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	80
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1599 ± 1981	5251 ± 825	104.1 ± 309.2	362 ± 318	2513 ± 1237	0
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

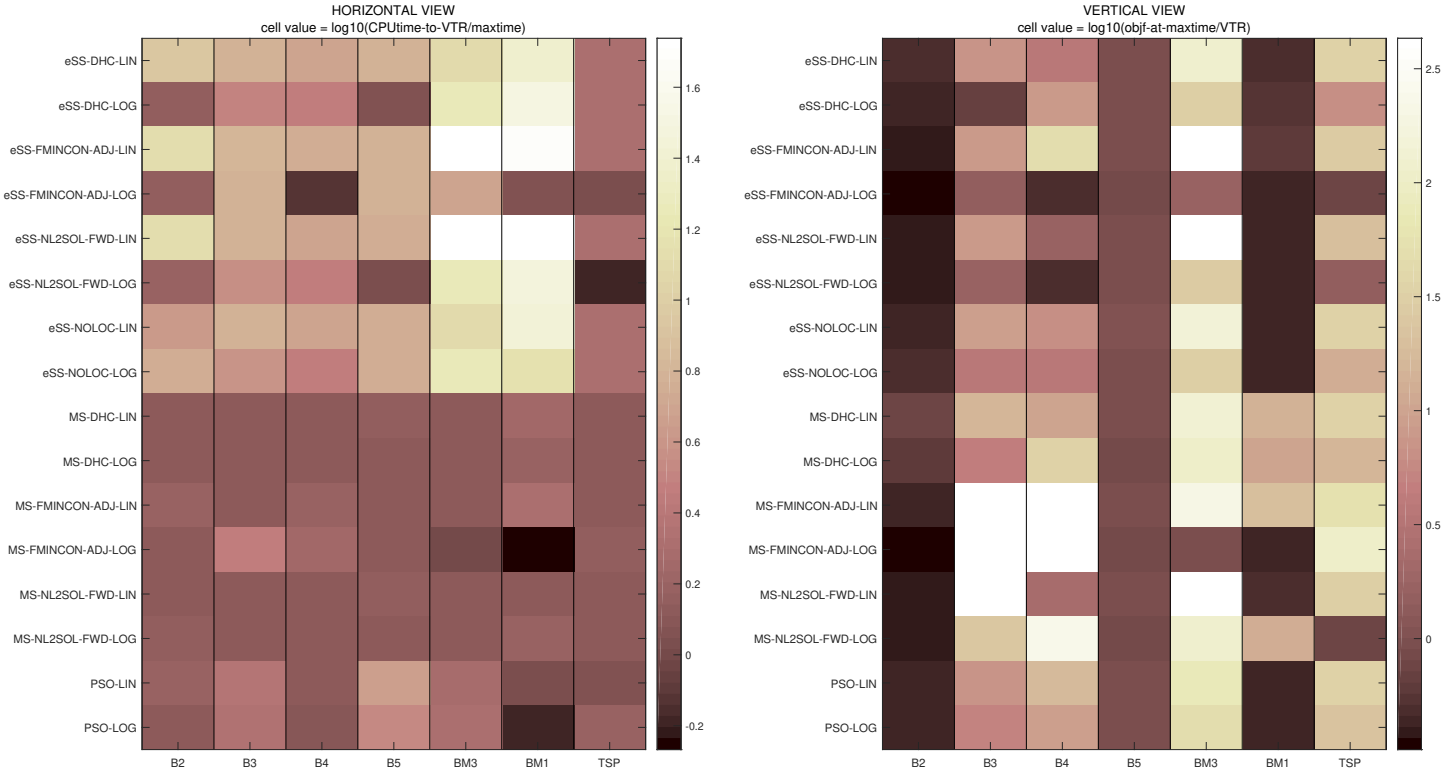

Figure S75: Result summary of horizontal and vertical views with VTR F, MAXT A in Table S1.

4.3.12 VTR F, MAXT B

Table S14: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR F; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	140574 ± 46511	14193 ± 2721	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	0
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	0
B2	MS-FMINCON-ADJ-LOG	0.3345 ± 0.01745	2177 ± 1158	7752 ± 1639	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	0
B2	MS-DHC-LOG	0.6185 ± 0.03374	11567 ± 104	6626 ± 86	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	0
B2	MS-NL2SOL-FWD-LOG	0.3685 ± 0.01925	293 ± 111	7526 ± 589	0.3743 ± 0.01805	106 ± 157	4570 ± 438	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	0
B2	MS-FMINCON-ADJ-LIN	0.4077 ± 0.1287	4904 ± 1148	8183 ± 1047	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	0
B2	MS-DHC-LIN	0.7796 ± 0.04802	11600 ± 0	6704 ± 114	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	0
B2	MS-NL2SOL-FWD-LIN	0.4218 ± 0.02543	580 ± 530	7975 ± 1589	0.4438 ± 0.04447	216 ± 468	4370 ± 804	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.08348 ± 0.01574	1039044 ± 540138	627542 ± 54326	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.0688 ± 0.0008946	1465283 ± 1039299	328033 ± 182064	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	0
B3	eSS-NOLOC-LOG	0.1221 ± 0.1622	1588823 ± 512679	385156 ± 69986	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.06856 ± 3.348e-06	2307518 ± 1087778	358169 ± 113708	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.233 ± 2.006	1202648 ± 1444899	596921 ± 50183	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.781 ± 2.216	567957 ± 1041335	612341 ± 8534	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.06154 ± 0.0005754	29801 ± 16354	7419 ± 3732	2799 ± 6064	9828 ± 7412	2217 ± 1677	30
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.1856 ± 0.1877	1301483 ± 263873	28814 ± 7	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	0
B4	MS-FMINCON-ADJ-LOG	0.2498 ± 0.3917	3378 ± 5707	11853 ± 5752	16.71 ± 36.7	337 ± 692	2370 ± 1501	0
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	0
B4	MS-FMINCON-ADJ-LIN	0.1618 ± 0.271	7915 ± 4977	11644 ± 2883	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	0
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002452	197477 ± 36464	58783 ± 849	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	52613 ± 8681	10909 ± 73	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	0
B5	MS-FMINCON-ADJ-LOG	0.8542 ± 0.003445	603 ± 159	7089 ± 497	0.8561 ± 0.004511	546 ± 125	4322 ± 407	0
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8567 ± 0.001715	90 ± 25	6711 ± 95	0.8594 ± 0.004863	74 ± 26	4789 ± 180	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S14 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR F; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4201 ± 0.0008123	17230 ± 17442	1115 ± 810	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	30
BM1	eSS-DHC-LOG	0.4266 ± 0.001536	1015580 ± 11481	31740 ± 2885	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	0
BM1	eSS-NOLOC-LOG	0.4271 ± 0.0007037	503053 ± 55042	14405 ± 4	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	0
BM1	eSS-NL2SOL-FWD-LOG	0.425 ± 0.002482	456174 ± 139256	30062 ± 11397	0.5228 ± 0.0997	773 ± 741	176 ± 183	0
BM1	MS-FMINCON-ADJ-LOG	0.4198 ± 0.0007931	864 ± 188	449 ± 188	0.4217 ± 0.003815	370 ± 237	381 ± 92	70
BM1	MS-DHC-LOG	0.4675 ± 0.03976	30568 ± 10770	1510 ± 517	29.88 ± 60.84	3571 ± 4656	220 ± 188	0
BM1	MS-NL2SOL-FWD-LOG	0.4438 ± 0.03561	85 ± 41	1096 ± 427	85.38 ± 131.2	12 ± 21	126 ± 176	0
BM1	PSO-LOG	0.4359 ± 0.008588	23863 ± 16860	667 ± 441	0.4424 ± 0.006082	16450 ± 794	499 ± 1	0
BM1	eSS-FMINCON-ADJ-LIN	0.4222 ± 0.006128	200608 ± 105567	47971 ± 23582	0.6407 ± 0.2708	658 ± 294	160 ± 176	0
BM1	eSS-DHC-LIN	0.4327 ± 0.008184	1019682 ± 25918	24401 ± 1436	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	0
BM1	eSS-NOLOC-LIN	0.4274 ± 0.00199	1000180 ± 141	27232 ± 2793	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	0
BM1	eSS-NL2SOL-FWD-LIN	0.4233 ± 0.001766	1537120 ± 524239	54695 ± 13286	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	0
BM1	MS-FMINCON-ADJ-LIN	0.4328 ± 0.006424	1682 ± 1007	1316 ± 629	21.52 ± 49.73	300 ± 293	182 ± 182	0
BM1	MS-DHC-LIN	0.5171 ± 0.06441	37066 ± 3903	1180 ± 255	9.56 ± 19.85	4233 ± 5527	133 ± 134	0
BM1	MS-NL2SOL-FWD-LIN	0.4657 ± 0.02369	13 ± 6	664 ± 11	0.4922 ± 0.07692	12 ± 6	479 ± 20	0
BM1	PSO-LIN	0.4419 ± 0.009461	40210 ± 27097	1037 ± 756	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	0
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.019 ± 0.3833	2912 ± 1081	65694 ± 11449	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	10
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7691 ± 0.3194	36162 ± 41095	3749 ± 2840	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	27
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.518 ± 2.562	16140 ± 8294	1180 ± 556	60
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	1969 ± 2403	3440 ± 1342	12.85 ± 17.1	452 ± 388	1119 ± 499	0
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	326 ± 241	2356 ± 13	0.7633 ± 0.2003	72 ± 170	1785 ± 9	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

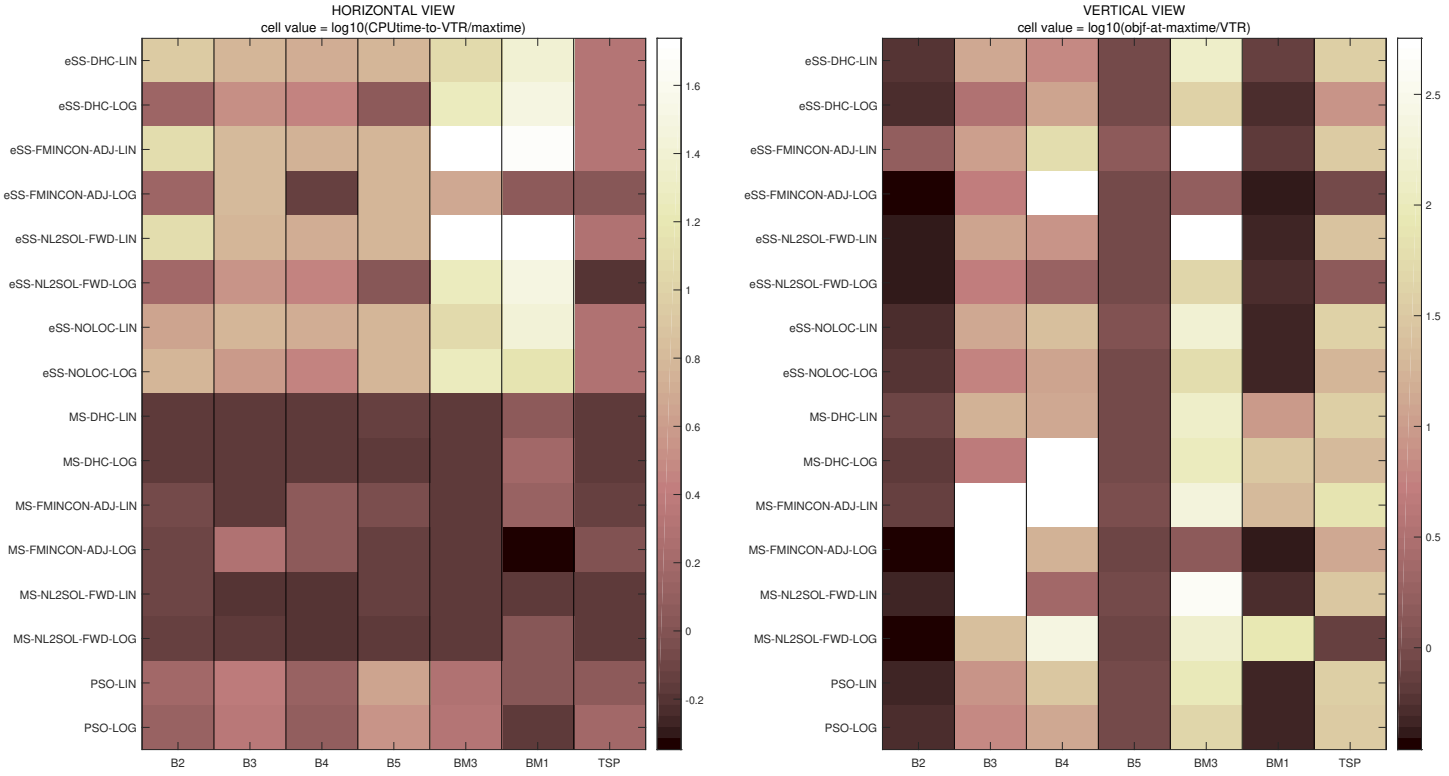

Figure S76: Result summary of horizontal and vertical views with VTR F, MAXT B in Table S1.

4.3.13 VTR G, MAXT A

Table S15: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR G; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	126446 ± 59507	13045 ± 4377	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	20
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	0
B2	MS-FMINCON-ADJ-LOG	0.3234 ± 0.01017	2453 ± 969	13493 ± 2681	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	10
B2	MS-DHC-LOG	0.5977 ± 0.02913	11600 ± 0	13146 ± 75	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	0
B2	MS-NL2SOL-FWD-LOG	0.3597 ± 0.02073	223 ± 94	13828 ± 600	0.3678 ± 0.02136	167 ± 196	9233 ± 725	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	0
B2	MS-FMINCON-ADJ-LIN	0.3617 ± 0.02682	5308 ± 1183	14927 ± 1062	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	0
B2	MS-DHC-LIN	0.7281 ± 0.03608	10297 ± 3533	13112 ± 89	0.739 ± 0.04345	11420 ± 569	9889 ± 102	0
B2	MS-NL2SOL-FWD-LIN	0.3992 ± 0.01643	666 ± 613	13612 ± 805	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.1102 ± 0.00347	348246 ± 152448	297457 ± 155893	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	0
B3	eSS-DHC-LOG	0.09456 ± 0.009468	456904 ± 708215	160519 ± 112171	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	50
B3	eSS-NOLOC-LOG	0.1566 ± 0.1501	471588 ± 725706	192940 ± 92514	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	0
B3	eSS-NL2SOL-FWD-LOG	0.1092 ± 0.0002565	297825 ± 157348	124913 ± 35769	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	40
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.24 ± 1.997	916924 ± 1272325	556738 ± 120554	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.787 ± 2.205	281343 ± 465182	580109 ± 72744	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.06334 ± 0.00414	17995 ± 12982	4897 ± 2600	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	3.766 ± 4.028	532986 ± 34062	9925 ± 74	0
B4	eSS-NL2SOL-FWD-LOG	0.1872 ± 0.1866	742211 ± 657237	16066 ± 13497	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	50
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2888 ± 4900	13666 ± 6674	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	30
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	0
B4	MS-FMINCON-ADJ-LIN	0.06912 ± 0.007701	7824 ± 5033	11480 ± 6108	3152 ± 8915	1360 ± 3299	4588 ± 3496	40
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002451	162839 ± 70977	47727 ± 18232	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	51181 ± 11193	10557 ± 1076	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	10
B5	MS-FMINCON-ADJ-LOG	0.853 ± 0.002345	524 ± 164	8726 ± 5159	0.8535 ± 0.002632	486 ± 143	9351 ± 545	50
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8562 ± 0.001112	131 ± 150	13135 ± 126	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1254 ± 146	13361 ± 3835	0.938 ± 0.05679	93 ± 292	7879 ± 1757	10
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	0

Table S15 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR G; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4325 ± 0.01033	1101 ± 810	154 ± 108	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.4441 ± 0.00643	27521 ± 12400	859 ± 381	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	60
BM1	eSS-NOLOC-LOG	0.4499 ± 0.001676	4073 ± 2890	110 ± 73	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.4413 ± 0.008287	819 ± 725	531 ± 229	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.4687 ± 0.03898	26722 ± 13127	1496 ± 419	9.84 ± 27	6449 ± 8049	396 ± 345	10
BM1	MS-NL2SOL-FWD-LOG	0.4451 ± 0.01311	75 ± 31	708 ± 423	12.09 ± 36.8	44 ± 32	636 ± 266	80
BM1	PSO-LOG	0.4517 ± 0.002309	3600 ± 1653	116 ± 53	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.4388 ± 0.00624	1344 ± 538	749 ± 509	0.6322 ± 0.2762	736 ± 351	228 ± 235	60
BM1	eSS-DHC-LIN	0.4447 ± 0.00562	76187 ± 41553	1911 ± 1076	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	20
BM1	eSS-NOLOC-LIN	0.4493 ± 0.00333	13882 ± 3855	379 ± 127	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.4477 ± 0.005983	6177 ± 3710	251 ± 116	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.4852 ± 0.046	31775 ± 11366	1760 ± 279	13.58 ± 27.47	24370 ± 16289	618 ± 347	0
BM1	MS-NL2SOL-FWD-LIN	0.4505 ± 0.001743	16 ± 3	577 ± 549	0.4566 ± 0.01809	9 ± 4	978 ± 14	70
BM1	PSO-LIN	0.4512 ± 0.0002338	14990 ± 8661	383 ± 225	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9112 ± 0.3146	3105 ± 1011	98933 ± 40060	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	50
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7693 ± 0.3194	35752 ± 41397	3683 ± 2883	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	64
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	80
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1599 ± 1981	5251 ± 825	104.1 ± 309.2	362 ± 318	2513 ± 1237	0
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

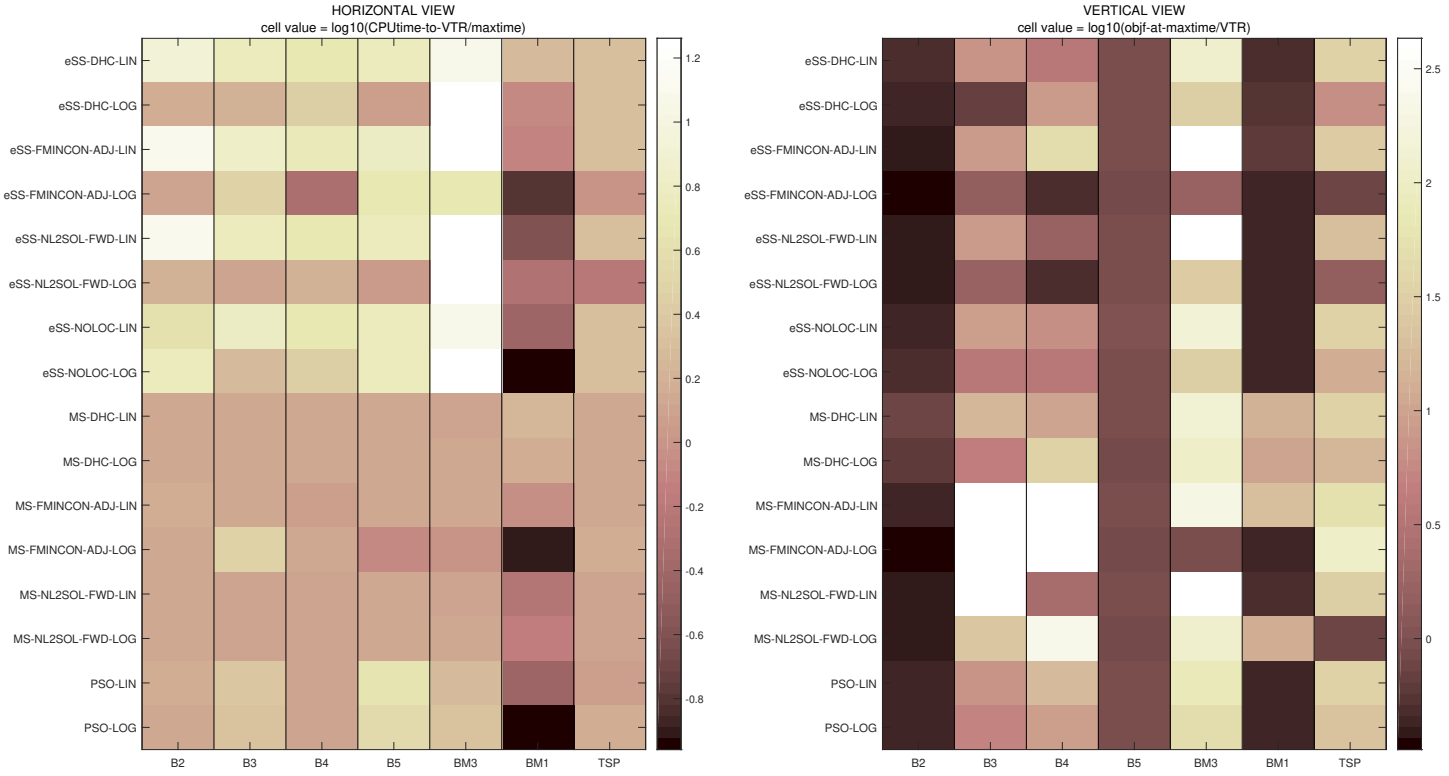

Figure S77: Result summary of horizontal and vertical views with VTR G, MAXT A in Table S1.

4.3.14 VTR G, MAXT B

Table S16: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR G; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3365 ± 0.01775	126446 ± 59507	13045 ± 4377	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	10
B2	eSS-DHC-LOG	0.4235 ± 0.04099	472769 ± 20571	14500 ± 54	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	0
B2	eSS-NOLOC-LOG	0.3694 ± 0.009719	2023964 ± 351043	57623 ± 11	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3716 ± 0.02016	121620 ± 36030	15633 ± 1056	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	0
B2	MS-FMINCON-ADJ-LOG	0.3345 ± 0.01745	2309 ± 1023	6728 ± 3053	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	20
B2	MS-DHC-LOG	0.6185 ± 0.03374	11567 ± 104	6626 ± 86	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	0
B2	MS-NL2SOL-FWD-LOG	0.3685 ± 0.01925	293 ± 111	7526 ± 589	0.3743 ± 0.01805	106 ± 157	4570 ± 438	0
B2	PSO-LOG	0.4576 ± 0.07663	635570 ± 265630	13247 ± 4979	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3457 ± 0.01136	643966 ± 80452	131289 ± 841	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	0
B2	eSS-DHC-LIN	0.3495 ± 0.008835	3878899 ± 179680	86431 ± 14	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	0
B2	eSS-NOLOC-LIN	0.3844 ± 0.008641	2814047 ± 94488	43209 ± 5	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	0
B2	eSS-NL2SOL-FWD-LIN	0.357 ± 0.01332	2053095 ± 940486	130020 ± 545	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	0
B2	MS-FMINCON-ADJ-LIN	0.4077 ± 0.1287	4904 ± 1148	8183 ± 1047	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	0
B2	MS-DHC-LIN	0.7796 ± 0.04802	11600 ± 0	6704 ± 114	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	0
B2	MS-NL2SOL-FWD-LIN	0.4218 ± 0.02543	580 ± 530	7975 ± 1589	0.4438 ± 0.04447	216 ± 468	4370 ± 804	0
B2	PSO-LIN	0.4324 ± 0.04535	667750 ± 380745	14964 ± 9273	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.1102 ± 0.00347	348246 ± 152448	297457 ± 155893	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.09456 ± 0.009468	456904 ± 708215	160519 ± 112171	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	0
B3	eSS-NOLOC-LOG	0.1566 ± 0.1501	471588 ± 725706	192940 ± 92514	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.1092 ± 0.0002565	297825 ± 157348	124913 ± 35769	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.683 ± 1.88	170584 ± 234748	657283 ± 138144	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.24 ± 1.997	916924 ± 1272325	556738 ± 120554	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.029 ± 1.875	1061345 ± 2070552	607836 ± 16664	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.787 ± 2.205	281343 ± 465182	580109 ± 72744	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.06334 ± 0.00414	17995 ± 12982	4897 ± 2600	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.485 ± 2.645	1329693 ± 82437	28956 ± 161	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	0.8657 ± 1.187	1528233 ± 104357	28811 ± 10	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.1872 ± 0.1866	742211 ± 657237	16066 ± 13497	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	40
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3604 ± 5603	10942 ± 6828	16.71 ± 36.7	337 ± 692	2370 ± 1501	20
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.4719 ± 0.4115	2665871 ± 463548	50447 ± 59	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	0
B4	MS-FMINCON-ADJ-LIN	0.165 ± 0.2697	5840 ± 5473	9470 ± 4761	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	20
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8545 ± 0.002451	162839 ± 70977	47727 ± 18232	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	0
B5	eSS-DHC-LOG	0.8964 ± 0.0377	62132 ± 12071	11734 ± 858	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.879 ± 0.02864	298871 ± 52878	57673 ± 55	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9128 ± 0.04129	51181 ± 11193	10557 ± 1076	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	0
B5	MS-FMINCON-ADJ-LOG	0.8542 ± 0.003445	625 ± 144	5797 ± 2188	0.8561 ± 0.004511	546 ± 125	4322 ± 407	40
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8567 ± 0.001715	90 ± 25	6711 ± 95	0.8594 ± 0.004863	74 ± 26	4789 ± 180	0
B5	PSO-LOG	0.8949 ± 0.03633	231580 ± 114900	34399 ± 18667	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04354	78147 ± 15985	60042 ± 3513	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	0
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07628	186633 ± 63625	57745 ± 120	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9148 ± 0.05817	178251 ± 58827	58065 ± 551	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9003 ± 0.05496	219630 ± 103848	44950 ± 14950	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S16 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR G; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.4325 ± 0.01033	1101 ± 810	154 ± 108	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	0.4441 ± 0.00643	27521 ± 12400	859 ± 381	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	20
BM1	eSS-NOLOC-LOG	0.4499 ± 0.001676	4073 ± 2890	110 ± 73	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	0.4413 ± 0.008287	819 ± 725	531 ± 229	0.5228 ± 0.0997	773 ± 741	176 ± 183	50
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	0.4675 ± 0.03976	27977 ± 11774	1308 ± 499	29.88 ± 60.84	3571 ± 4656	220 ± 188	10
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	69 ± 27	652 ± 320	85.38 ± 131.2	12 ± 21	126 ± 176	20
BM1	PSO-LOG	0.4517 ± 0.002309	3600 ± 1653	116 ± 53	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	0.4388 ± 0.00624	1344 ± 538	749 ± 509	0.6407 ± 0.2708	658 ± 294	160 ± 176	50
BM1	eSS-DHC-LIN	0.4447 ± 0.00562	76187 ± 41553	1911 ± 1076	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	10
BM1	eSS-NOLOC-LIN	0.4493 ± 0.00333	13882 ± 3855	379 ± 127	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	80
BM1	eSS-NL2SOL-FWD-LIN	0.4477 ± 0.005983	6177 ± 3710	251 ± 116	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.5171 ± 0.06441	37066 ± 3903	1180 ± 255	9.56 ± 19.85	4233 ± 5527	133 ± 134	0
BM1	MS-NL2SOL-FWD-LIN	0.4657 ± 0.02369	16 ± 5	493 ± 258	0.4922 ± 0.07692	12 ± 6	479 ± 20	30
BM1	PSO-LIN	0.4512 ± 0.0002338	14990 ± 8661	383 ± 225	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	75
BM3	eSS-FMINCON-ADJ-LOG	0.8674 ± 0.2495	291464 ± 151775	473597 ± 233497	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	0
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.019 ± 0.3833	2912 ± 1081	65694 ± 11449	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	10
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7693 ± 0.3194	35752 ± 41397	3683 ± 2883	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	36
MendesTSP	eSS-DHC-LOG	4.588 ± 5.719	115125 ± 6559	7378 ± 80	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.484 ± 2.572	30723 ± 37258	2260 ± 2594	1.518 ± 2.562	16140 ± 8294	1180 ± 556	60
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	1969 ± 2403	3440 ± 1342	12.85 ± 17.1	452 ± 388	1119 ± 499	0
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	326 ± 241	2356 ± 13	0.7633 ± 0.2003	72 ± 170	1785 ± 9	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

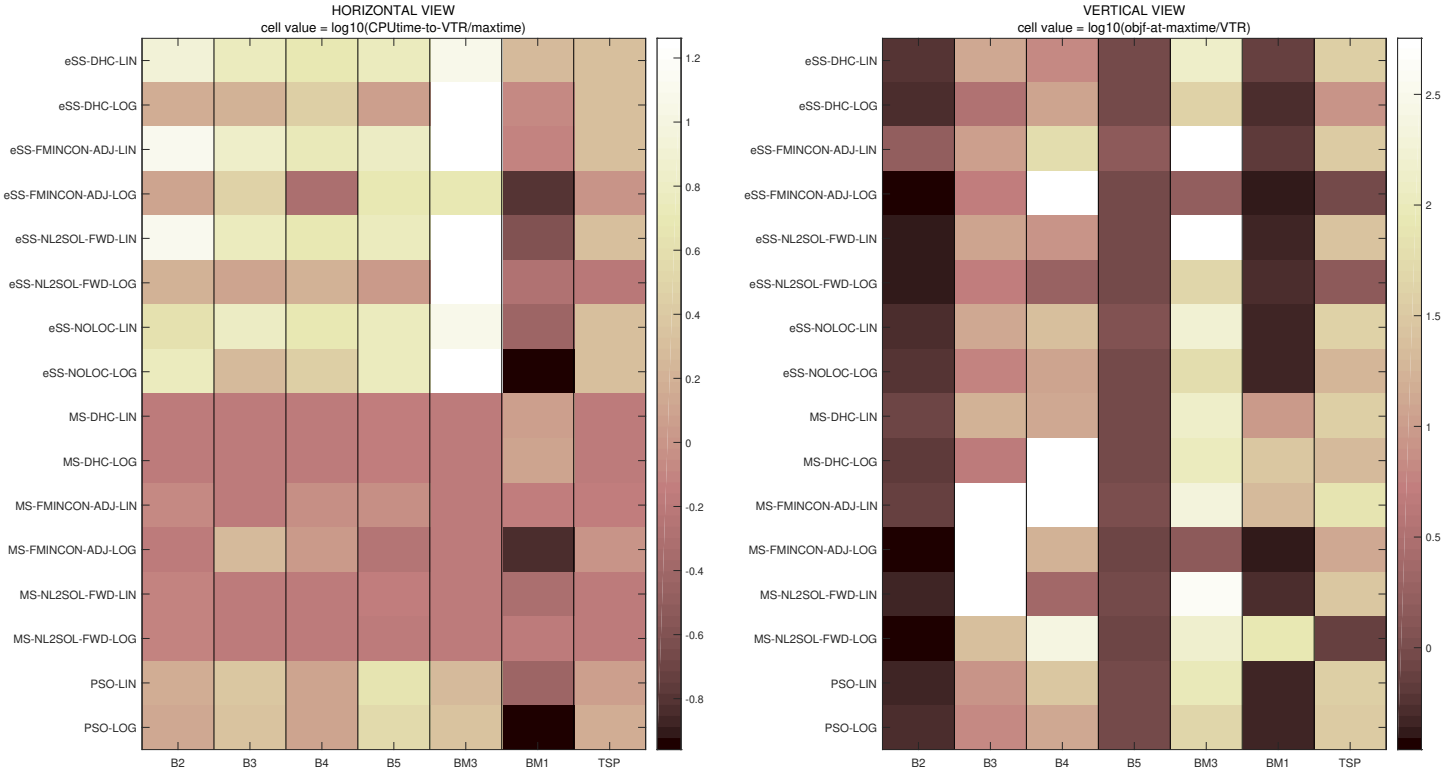

Figure S78: Result summary of horizontal and vertical views with VTR G, MAXT B in Table S1.

4.3.15 VTR H, MAXT A

Table S17: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR H; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.426 ± 0.03737	457922 ± 42558	14035 ± 1481	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	10
B2	eSS-NOLOC-LOG	0.3842 ± 0.001407	1453973 ± 446460	40893 ± 12197	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3797 ± 0.01111	65316 ± 60479	7987 ± 6041	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	50
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.5977 ± 0.02913	11600 ± 0	13146 ± 75	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	0
B2	MS-NL2SOL-FWD-LOG	0.3675 ± 0.01486	301 ± 87	7459 ± 5390	0.3678 ± 0.02136	167 ± 196	9233 ± 725	60
B2	PSO-LOG	0.4588 ± 0.07515	618700 ± 280945	12828 ± 5368	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	14
B2	eSS-FMINCON-ADJ-LIN	0.3663 ± 0.008511	27623 ± 19305	7330 ± 3577	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	80
B2	eSS-DHC-LIN	0.3844 ± 0.0003847	1450838 ± 504302	29306 ± 10914	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	0
B2	eSS-NOLOC-LIN	0.3879 ± 0.003646	2387431 ± 656929	36498 ± 9998	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	0
B2	eSS-NL2SOL-FWD-LIN	0.3776 ± 0.006308	465635 ± 1036287	26962 ± 36190	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	50
B2	MS-FMINCON-ADJ-LIN	0.3684 ± 0.02348	5000 ± 1253	11536 ± 4708	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	30
B2	MS-DHC-LIN	0.7281 ± 0.03608	10297 ± 3533	13112 ± 89	0.739 ± 0.04345	11420 ± 569	9889 ± 102	0
B2	MS-NL2SOL-FWD-LIN	0.3992 ± 0.01643	666 ± 613	13612 ± 805	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	0
B2	PSO-LIN	0.4329 ± 0.04475	654630 ± 362508	14649 ± 8790	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.4916 ± 0.02648	110119 ± 76071	151835 ± 118205	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	30
B3	eSS-DHC-LOG	0.295 ± 0.1298	120285 ± 164966	97902 ± 28123	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	50
B3	eSS-NOLOC-LOG	0.5013 ± 0.04204	301214 ± 774474	162183 ± 99533	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	10
B3	eSS-NL2SOL-FWD-LOG	0.4894 ± 0.0347	118123 ± 136755	101584 ± 35404	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	60
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.502 ± 0.06693	2663 ± 5405	136380 ± 5798	4.502 ± 0.06693	85 ± 178	94516 ± 5192	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	0
B3	eSS-FMINCON-ADJ-LIN	3.7 ± 1.846	160309 ± 224300	654273 ± 139949	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	2.319 ± 1.907	883431 ± 1269560	544153 ± 129638	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	0
B3	eSS-NOLOC-LIN	4.059 ± 1.805	812261 ± 1655188	578236 ± 96052	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	3.852 ± 2.084	211578 ± 325261	570921 ± 91532	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.487 ± 2.642	1293290 ± 142089	28160 ± 2485	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	0
B4	eSS-NOLOC-LOG	0.8799 ± 1.179	1413577 ± 255160	26692 ± 4514	3.766 ± 4.028	532986 ± 34062	9925 ± 74	0
B4	eSS-NL2SOL-FWD-LOG	0.2584 ± 0.1523	368678 ± 501399	8432 ± 11352	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	70
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	0.4785 ± 0.4069	2496422 ± 704521	47048 ± 10725	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	0
B4	MS-FMINCON-ADJ-LIN	0.08469 ± 0.02702	6095 ± 5686	8372 ± 6149	3152 ± 8915	1360 ± 3299	4588 ± 3496	60
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.8574 ± 0.002426	14494 ± 11766	5041 ± 4075	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	90
B5	eSS-DHC-LOG	0.8965 ± 0.03757	59900 ± 14153	11255 ± 1283	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	20
B5	eSS-NOLOC-LOG	0.8793 ± 0.02839	276663 ± 83752	52788 ± 10502	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	0
B5	eSS-NL2SOL-FWD-LOG	0.9131 ± 0.04087	41271 ± 25761	8113 ± 4494	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	30
B5	MS-FMINCON-ADJ-LOG	0.856 ± 0.002952	518 ± 94	2578 ± 1947	0.8535 ± 0.002632	486 ± 143	9351 ± 545	100
B5	MS-DHC-LOG	0.869 ± 0.006058	8307 ± 798	13650 ± 473	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	0
B5	MS-NL2SOL-FWD-LOG	0.8576 ± 0.001153	80 ± 20	2402 ± 2331	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	100
B5	PSO-LOG	0.8954 ± 0.03585	186680 ± 84919	27744 ± 14591	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04348	61723 ± 28044	50240 ± 20249	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	5
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07617	179921 ± 45842	56614 ± 3581	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9152 ± 0.05778	159054 ± 64438	53953 ± 13050	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	0
B5	MS-FMINCON-ADJ-LIN	0.929 ± 0.04699	1254 ± 146	13361 ± 3835	0.938 ± 0.05679	93 ± 292	7879 ± 1757	10
B5	MS-DHC-LIN	0.8819 ± 0.01467	8031 ± 931	14036 ± 769	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	0
B5	MS-NL2SOL-FWD-LIN	0.8888 ± 0.01769	138 ± 32	13850 ± 488	0.9112 ± 0.04341	160 ± 155	9299 ± 417	0
B5	PSO-LIN	0.9011 ± 0.05429	162240 ± 91914	36103 ± 19995	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	10

Table S17 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR H; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.5752 ± 0.1136	462 ± 393	57 ± 109	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	0.5401 ± 0.08212	5332 ± 11432	149 ± 320	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	90
BM1	eSS-NOLOC-LOG	0.6277 ± 0.0708	509 ± 269	14 ± 7	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	0.5713 ± 0.09317	478 ± 131	50 ± 80	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	0.4724 ± 0.04293	27331 ± 12445	1215 ± 608	9.84 ± 27	6449 ± 8049	396 ± 345	40
BM1	MS-NL2SOL-FWD-LOG	0.4519 ± 0.03306	76 ± 30	589 ± 352	12.09 ± 36.8	44 ± 32	636 ± 266	90
BM1	PSO-LOG	0.6829 ± 0.06923	750 ± 566	29 ± 18	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	0.5459 ± 0.1286	947 ± 751	477 ± 613	0.6322 ± 0.2762	736 ± 351	228 ± 235	70
BM1	eSS-DHC-LIN	0.4875 ± 0.06491	22787 ± 11900	572 ± 282	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	100
BM1	eSS-NOLOC-LIN	0.6392 ± 0.06676	1113 ± 572	31 ± 15	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	0.6598 ± 0.08414	839 ± 566	33 ± 27	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.5625 ± 0.104	30608 ± 13383	757 ± 345	13.58 ± 27.47	24370 ± 16289	618 ± 347	80
BM1	MS-NL2SOL-FWD-LIN	0.4894 ± 0.0615	15 ± 5	107 ± 60	0.4566 ± 0.01809	9 ± 4	978 ± 14	100
BM1	PSO-LIN	0.6738 ± 0.04814	1160 ± 508	32 ± 13	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.9868 ± 0.3387	46904 ± 60038	82416 ± 105278	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	67
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	0.9457 ± 0.3053	2653 ± 1344	68821 ± 42113	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	80
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7708 ± 0.3189	14502 ± 30391	1905 ± 1857	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	91
MendesTSP	eSS-DHC-LOG	4.59 ± 5.718	112506 ± 7042	7228 ± 475	6.107 ± 8.079	48384 ± 10824	3158 ± 716	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.486 ± 2.571	19895 ± 31978	1454 ± 2181	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	90
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1668 ± 1940	4829 ± 1696	104.1 ± 309.2	362 ± 318	2513 ± 1237	10
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	114 ± 163	4689 ± 12	0.7633 ± 0.2003	68 ± 172	3583 ± 13	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

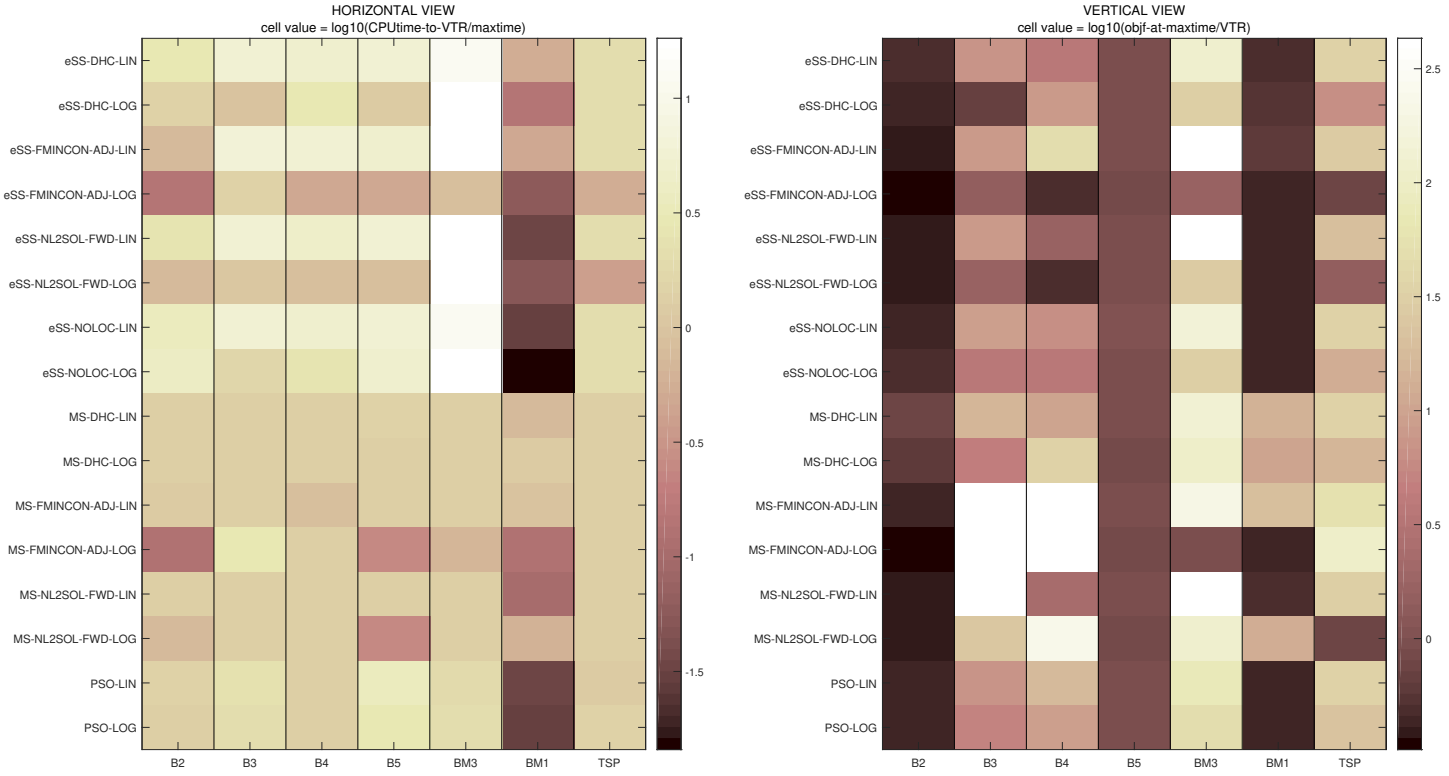

Figure S79: Result summary of horizontal and vertical views with VTR H, MAXT A in Table S1.

4.3.16 VTR H, MAXT B

Table S18: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR H; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.426 ± 0.03737	457922 ± 42558	14035 ± 1481	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	0
B2	eSS-NOLOC-LOG	0.3842 ± 0.001407	1453973 ± 446460	40893 ± 12197	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	0
B2	eSS-NL2SOL-FWD-LOG	0.3797 ± 0.01111	65316 ± 60479	7987 ± 6041	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	50
B2	MS-FMINCON-ADJ-LOG	0.3392 ± 0.01939	1815 ± 746	3309 ± 3877	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	70
B2	MS-DHC-LOG	0.6185 ± 0.03374	11567 ± 104	6626 ± 86	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	0
B2	MS-NL2SOL-FWD-LOG	0.3743 ± 0.01805	323 ± 101	3849 ± 1995	0.3743 ± 0.01805	106 ± 157	4570 ± 438	80
B2	PSO-LOG	0.4588 ± 0.07515	618700 ± 280945	12828 ± 5368	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	0
B2	eSS-FMINCON-ADJ-LIN	0.3663 ± 0.008511	27623 ± 19305	7330 ± 3577	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	20
B2	eSS-DHC-LIN	0.3844 ± 0.0003847	1450838 ± 504302	29306 ± 10914	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	0
B2	eSS-NOLOC-LIN	0.3879 ± 0.003646	2387431 ± 656929	36498 ± 9998	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	0
B2	eSS-NL2SOL-FWD-LIN	0.3776 ± 0.006308	465635 ± 1036287	26962 ± 36190	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	50
B2	MS-FMINCON-ADJ-LIN	0.4087 ± 0.1284	5021 ± 1303	6140 ± 2413	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	50
B2	MS-DHC-LIN	0.7796 ± 0.04802	11600 ± 0	6704 ± 114	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	0
B2	MS-NL2SOL-FWD-LIN	0.4218 ± 0.02543	580 ± 530	7975 ± 1589	0.4438 ± 0.04447	216 ± 468	4370 ± 804	0
B2	PSO-LIN	0.4329 ± 0.04475	654630 ± 362508	14649 ± 8790	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	0
B3	eSS-FMINCON-ADJ-LOG	0.4916 ± 0.02648	110119 ± 76071	151835 ± 118205	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	0
B3	eSS-DHC-LOG	0.295 ± 0.1298	120285 ± 164966	97902 ± 28123	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	0
B3	eSS-NOLOC-LOG	0.5013 ± 0.04204	301214 ± 774474	162183 ± 99533	5.936 ± 1.565	2263 ± 618	34663 ± 10644	0
B3	eSS-NL2SOL-FWD-LOG	0.4894 ± 0.0347	118123 ± 136755	101584 ± 35404	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	0
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	4226 ± 7197	68097 ± 3238	4.502 ± 0.08198	301 ± 537	47198 ± 4740	0
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	4.805 ± 1.191	21740 ± 8358	218624 ± 54556	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	3.7 ± 1.846	160309 ± 224300	654273 ± 139949	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	2.319 ± 1.907	883431 ± 1269560	544153 ± 129638	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	0
B3	eSS-NOLOC-LIN	4.059 ± 1.805	812261 ± 1655188	578236 ± 96052	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	3.852 ± 2.084	211578 ± 325261	570921 ± 91532	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	5.913 ± 1.666	37220 ± 25125	236864 ± 48035	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.487 ± 2.642	1293290 ± 142089	28160 ± 2485	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	0.8799 ± 1.179	1413577 ± 255160	26692 ± 4514	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.2584 ± 0.1523	368678 ± 501399	8432 ± 11352	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	60
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3767 ± 5512	10536 ± 7182	16.71 ± 36.7	337 ± 692	2370 ± 1501	30
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.33 ± 34.78	437910 ± 306645	12814 ± 8621	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.296 ± 7.664	896496 ± 430612	55031 ± 6080	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	0.5604 ± 0.1328	3151465 ± 304512	50441 ± 38	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	0
B4	eSS-NOLOC-LIN	0.7614 ± 0.2379	3221153 ± 195430	50408 ± 7	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	0.4785 ± 0.4069	2496422 ± 704521	47048 ± 10725	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	0
B4	MS-FMINCON-ADJ-LIN	0.1893 ± 0.2642	4087 ± 5455	6157 ± 4093	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	50
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.63 ± 70.26	584310 ± 703679	13012 ± 16108	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.8574 ± 0.002426	14494 ± 11766	5041 ± 4075	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	50
B5	eSS-DHC-LOG	0.8965 ± 0.03757	59900 ± 14153	11255 ± 1283	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	0
B5	eSS-NOLOC-LOG	0.8793 ± 0.02839	276663 ± 83752	52788 ± 10502	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	0
B5	eSS-NL2SOL-FWD-LOG	0.9131 ± 0.04087	41271 ± 25761	8113 ± 4494	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	30
B5	MS-FMINCON-ADJ-LOG	0.8562 ± 0.003151	543 ± 103	3300 ± 1495	0.8561 ± 0.004511	546 ± 125	4322 ± 407	90
B5	MS-DHC-LOG	0.8794 ± 0.02261	7478 ± 1476	6987 ± 397	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	0
B5	MS-NL2SOL-FWD-LOG	0.8578 ± 0.001693	66 ± 12	2708 ± 2194	0.8594 ± 0.004863	74 ± 26	4789 ± 180	70
B5	PSO-LOG	0.8954 ± 0.03585	186680 ± 84919	27744 ± 14591	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	0
B5	eSS-FMINCON-ADJ-LIN	0.8887 ± 0.04348	61723 ± 28044	50240 ± 20249	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	5
B5	eSS-DHC-LIN	0.9274 ± 0.06746	251385 ± 122989	58721 ± 1056	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	0
B5	eSS-NOLOC-LIN	0.9675 ± 0.07617	179921 ± 45842	56614 ± 3581	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9152 ± 0.05778	159054 ± 64438	53953 ± 13050	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	0
B5	MS-FMINCON-ADJ-LIN	0.9708 ± 0.0726	1503 ± 611	9115 ± 1913	1.012 ± 0.08305	1 ± 0	4066 ± 877	0
B5	MS-DHC-LIN	0.9025 ± 0.03541	8487 ± 358	7279 ± 598	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	0
B5	MS-NL2SOL-FWD-LIN	0.9127 ± 0.0284	182 ± 142	7230 ± 612	0.9161 ± 0.03134	168 ± 35	4416 ± 512	0
B5	PSO-LIN	0.9011 ± 0.05429	162240 ± 91914	36103 ± 19995	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	0

Table S18 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR H; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.5752 ± 0.1136	462 ± 393	57 ± 109	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	0.5401 ± 0.08212	5332 ± 11432	149 ± 320	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	90
BM1	eSS-NOLOC-LOG	0.6277 ± 0.0708	509 ± 269	14 ± 7	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	0.5713 ± 0.09317	478 ± 131	50 ± 80	0.5228 ± 0.0997	773 ± 741	176 ± 183	100
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	0.4871 ± 0.06421	26535 ± 13717	1171 ± 619	29.88 ± 60.84	3571 ± 4656	220 ± 188	30
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	68 ± 28	611 ± 342	85.38 ± 131.2	12 ± 21	126 ± 176	30
BM1	PSO-LOG	0.6829 ± 0.06923	750 ± 566	29 ± 18	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	0.5459 ± 0.1286	947 ± 751	477 ± 613	0.6407 ± 0.2708	658 ± 294	160 ± 176	70
BM1	eSS-DHC-LIN	0.4875 ± 0.06491	22787 ± 11900	572 ± 282	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	40
BM1	eSS-NOLOC-LIN	0.6392 ± 0.06676	1113 ± 572	31 ± 15	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	100
BM1	eSS-NL2SOL-FWD-LIN	0.6598 ± 0.08414	839 ± 566	33 ± 27	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.6087 ± 0.1042	22123 ± 15944	573 ± 446	9.56 ± 19.85	4233 ± 5527	133 ± 134	40
BM1	MS-NL2SOL-FWD-LIN	0.5869 ± 0.1236	12 ± 3	134 ± 118	0.4922 ± 0.07692	12 ± 6	479 ± 20	100
BM1	PSO-LIN	0.6738 ± 0.04814	1160 ± 508	32 ± 13	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	0.9868 ± 0.3387	46904 ± 60038	82416 ± 105278	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	67
BM3	eSS-DHC-LOG	4.289 ± 2.732	2264775 ± 158978	1819481 ± 2759	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	6.928 ± 4.582	2227444 ± 258563	1818685 ± 2989	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	2.549 ± 0.5109	2017931 ± 295957	1825621 ± 8299	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	1.056 ± 0.3641	2127 ± 1475	44348 ± 23257	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	50
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.7708 ± 0.3189	14502 ± 30391	1905 ± 1857	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	64
MendesTSP	eSS-DHC-LOG	4.59 ± 5.718	112506 ± 7042	7228 ± 475	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.486 ± 2.571	19895 ± 31978	1454 ± 2181	1.518 ± 2.562	16140 ± 8294	1180 ± 556	80
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	2035 ± 2360	3237 ± 1607	12.85 ± 17.1	452 ± 388	1119 ± 499	10
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	326 ± 241	2356 ± 13	0.7633 ± 0.2003	72 ± 170	1785 ± 9	0
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

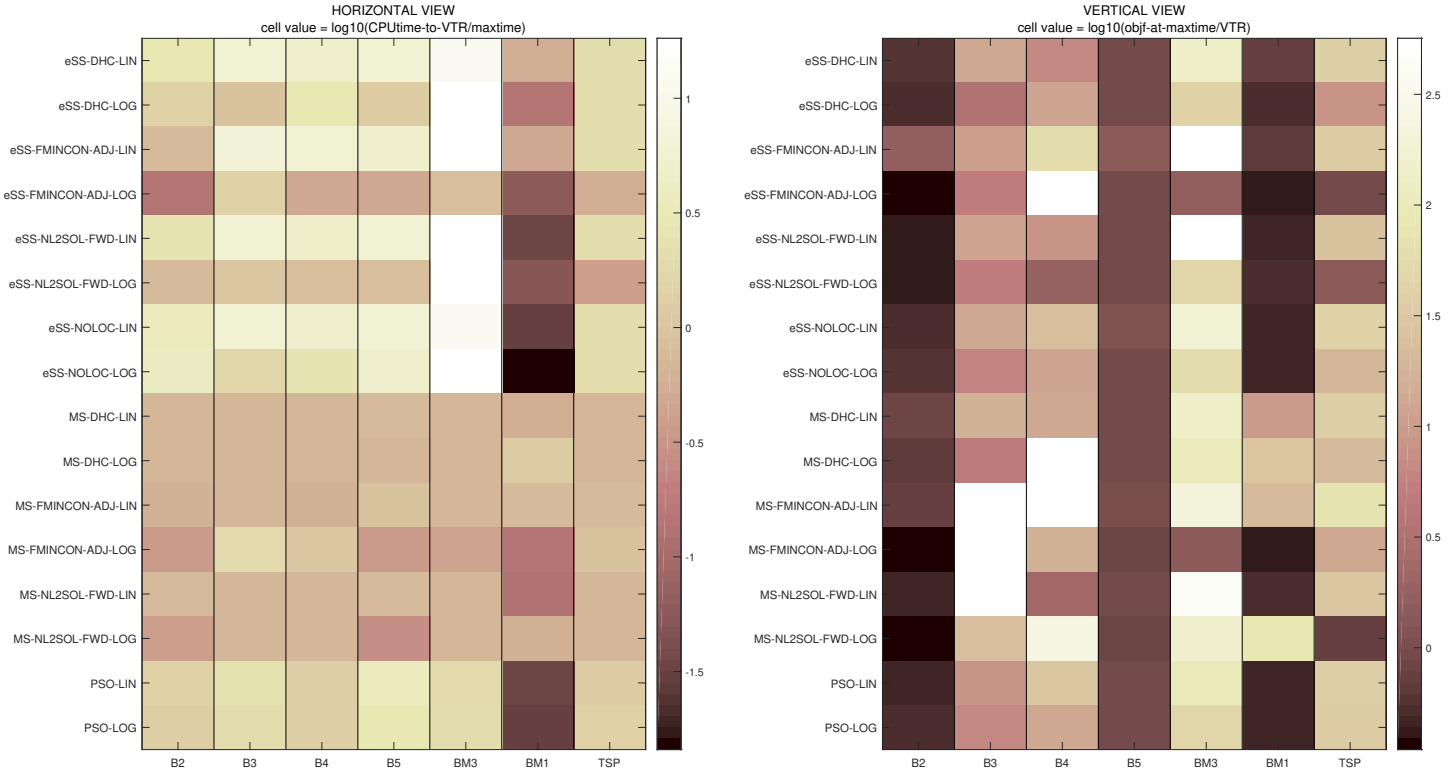

Figure S80: Result summary of horizontal and vertical views with VTR H, MAXT B in Table S1.

4.3.17 VTR I, MAXT A

Table S19: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR I; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3412 ± 0.01966	30833 ± 20253	4570 ± 2507	100
B2	eSS-DHC-LOG	0.7055 ± 0.1627	14916 ± 3357	472 ± 99	0.4474 ± 0.04378	327653 ± 18326	9895 ± 107	100
B2	eSS-NOLOC-LOG	1.025 ± 0.04088	14209 ± 2984	401 ± 87	0.4667 ± 0.02399	386827 ± 70416	9978 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.616 ± 0.2608	4170 ± 3418	1257 ± 1026	0.389 ± 0.04244	44202 ± 45959	4886 ± 2574	100
B2	MS-FMINCON-ADJ-LOG	0.3454 ± 0.01566	1913 ± 885	1295 ± 602	0.3259 ± 0.009249	2047 ± 1287	9004 ± 809	100
B2	MS-DHC-LOG	0.8213 ± 0.1283	11600 ± 0	371 ± 192	0.5996 ± 0.03288	7557 ± 5324	9924 ± 60	100
B2	MS-NL2SOL-FWD-LOG	0.391 ± 0.04693	293 ± 102	4185 ± 5170	0.3678 ± 0.02136	167 ± 196	9233 ± 725	80
B2	PSO-LOG	1.065 ± 0.01158	8330 ± 6076	178 ± 114	0.4345 ± 0.04395	481714 ± 54122	9999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.5669 ± 0.291	7122 ± 3273	2420 ± 2102	0.3681 ± 0.01184	22160 ± 11957	5798 ± 2176	100
B2	eSS-DHC-LIN	0.7784 ± 0.1043	20783 ± 12365	426 ± 258	0.4702 ± 0.03911	500857 ± 19769	9845 ± 231	100
B2	eSS-NOLOC-LIN	1.031 ± 0.0239	14745 ± 2928	228 ± 43	0.4489 ± 0.03508	676108 ± 24805	9936 ± 88	100
B2	eSS-NL2SOL-FWD-LIN	0.575 ± 0.2418	10648 ± 9120	1131 ± 707	0.3803 ± 0.01394	58313 ± 53162	5153 ± 3653	100
B2	MS-FMINCON-ADJ-LIN	0.5588 ± 0.2426	3645 ± 2158	6234 ± 5879	0.425 ± 0.1324	1424 ± 2396	8184 ± 1240	70
B2	MS-DHC-LIN	0.9386 ± 0.1245	11600 ± 0	668 ± 579	0.739 ± 0.04345	11420 ± 569	9889 ± 102	100
B2	MS-NL2SOL-FWD-LIN	0.5013 ± 0.06604	507 ± 544	2691 ± 3893	0.4039 ± 0.01803	253 ± 494	9088 ± 1257	90
B2	PSO-LIN	1.053 ± 0.01864	9170 ± 6566	198 ± 133	0.4436 ± 0.03424	461514 ± 28298	9999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	4.291 ± 0.4217	8877 ± 2060	66925 ± 33950	1.524 ± 1.716	81141 ± 41832	86880 ± 25061	90
B3	eSS-DHC-LOG	1.425 ± 0.8279	22934 ± 10973	44370 ± 20786	0.6404 ± 0.6587	132631 ± 111593	72407 ± 28969	100
B3	eSS-NOLOC-LOG	4.205 ± 0.2958	8090 ± 3479	85945 ± 34738	3.607 ± 1.726	16040 ± 16956	92636 ± 12921	80
B3	eSS-NL2SOL-FWD-LOG	4.162 ± 0.2939	9257 ± 1646	71176 ± 24122	1.751 ± 2.13	198285 ± 181074	98180 ± 3016	90
B3	MS-FMINCON-ADJ-LOG	35.88 ± 71.42	221 ± 190	292509 ± 129061	2.298e+25 ± 3.98e+25	1 ± 0	46417 ± 38343	10
B3	MS-DHC-LOG	4.531 ± 0.05797	1975 ± 2300	89413 ± 59062	4.502 ± 0.06693	85 ± 178	94516 ± 5192	40
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	130377 ± 503	23.35 ± 0	4 ± 0	99792 ± 230	0
B3	PSO-LOG	5.204 ± 0.7323	15430 ± 5994	151887 ± 49851	5.337 ± 0.7978	10390 ± 2307	98969 ± 1153	10
B3	eSS-FMINCON-ADJ-LIN	4.772 ± 0.7458	59988 ± 31199	467680 ± 165546	8.416 ± 1.36	9327 ± 2730	83794 ± 14617	0
B3	eSS-DHC-LIN	4.275 ± 0.7195	50990 ± 20838	288666 ± 199146	7.397 ± 2.51	9355 ± 5637	61502 ± 34705	10
B3	eSS-NOLOC-LIN	4.967 ± 0.8438	64515 ± 13536	438396 ± 183389	8.911 ± 0.6989	11074 ± 2281	94363 ± 5782	0
B3	eSS-NL2SOL-FWD-LIN	4.938 ± 0.6057	58876 ± 21218	472648 ± 172728	8.353 ± 1.375	7947 ± 2736	75186 ± 20408	0
B3	MS-FMINCON-ADJ-LIN	3.407e+09 ± 7.615e+09	1 ± 0	132645 ± 2820	1.316e+10 ± 2.566e+10	1 ± 0	97984 ± 2315	0
B3	MS-DHC-LIN	16.04 ± 0	160 ± 183	133614 ± 4105	16.05 ± 0.005736	183 ± 388	96861 ± 3339	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	130226 ± 323	1.195e+08 ± 0	4 ± 0	99857 ± 148	0
B3	PSO-LIN	6.057 ± 1.496	33060 ± 24311	211327 ± 52441	6.796 ± 1.342	13120 ± 7084	99463 ± 457	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	0.5085 ± 1.412	18794 ± 14864	4793 ± 2484	90
B4	eSS-DHC-LOG	3.932 ± 2.105	1034979 ± 457465	22387 ± 9509	8.081 ± 5.826	375711 ± 100759	8410 ± 2193	20
B4	eSS-NOLOC-LOG	2.195 ± 0.6907	644297 ± 418381	11886 ± 6951	3.766 ± 4.028	532986 ± 34062	9925 ± 74	40
B4	eSS-NL2SOL-FWD-LOG	0.813 ± 0.6993	124050 ± 175568	2877 ± 4070	0.4952 ± 0.8275	285804 ± 123675	6679 ± 2839	90
B4	MS-FMINCON-ADJ-LOG	0.5714 ± 1.108	2975 ± 4868	12677 ± 7455	9.92e+04 ± 2.218e+05	191 ± 309	4821 ± 3903	40
B4	MS-DHC-LOG	22.27 ± 21.91	11167 ± 1337	13305 ± 163	34.92 ± 21.91	146 ± 306	9794 ± 246	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 3.254e-14	71 ± 169	13030 ± 35	239.1 ± 3.254e-14	5 ± 3	9977 ± 19	0
B4	PSO-LOG	19.4 ± 34.74	392250 ± 274359	11489 ± 7743	9.161 ± 6.466	348850 ± 46616	9998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.689 ± 7.371	745367 ± 301766	50083 ± 11123	45.96 ± 34.04	74325 ± 66619	6414 ± 2952	0
B4	eSS-DHC-LIN	1.501 ± 0.5449	982524 ± 462128	16582 ± 10383	3.823 ± 1.849	514983 ± 121989	8215 ± 1890	20
B4	eSS-NOLOC-LIN	1.997 ± 0.1256	1148592 ± 480112	17744 ± 6632	6.584 ± 3.312	634106 ± 32020	9956 ± 55	0
B4	eSS-NL2SOL-FWD-LIN	1.343 ± 0.5434	395551 ± 258107	6866 ± 4424	1.622 ± 1.389	432684 ± 128346	7672 ± 2267	70
B4	MS-FMINCON-ADJ-LIN	0.1871 ± 0.2823	4654 ± 5062	6851 ± 5740	3152 ± 8915	1360 ± 3299	4588 ± 3496	70
B4	MS-DHC-LIN	8.483 ± 2.534	10628 ± 3389	13080 ± 57	9.459 ± 3.358	6106 ± 4740	9859 ± 111	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	179 ± 258	13016 ± 14	2.382 ± 0	10 ± 9	9985 ± 15	0
B4	PSO-LIN	40.76 ± 70.18	424950 ± 433263	9342 ± 9446	16.99 ± 18.96	450400 ± 60264	9998 ± 0	0
B5	eSS-FMINCON-ADJ-LOG	0.889 ± 0.03808	2223 ± 99	1599 ± 478	0.8582 ± 0.002649	27535 ± 12145	7677 ± 2256	100
B5	eSS-DHC-LOG	0.91 ± 0.03496	10620 ± 876	1927 ± 311	0.8979 ± 0.03707	50368 ± 11013	9438 ± 759	100
B5	eSS-NOLOC-LOG	0.9582 ± 0.003527	26590 ± 7970	4988 ± 1937	0.9021 ± 0.02839	53304 ± 10143	9927 ± 72	100
B5	eSS-NL2SOL-FWD-LOG	0.9228 ± 0.03633	1843 ± 12	746 ± 161	0.9129 ± 0.0413	43071 ± 8848	9008 ± 936	100
B5	MS-FMINCON-ADJ-LOG	0.8723 ± 0.03072	575 ± 211	1613 ± 652	0.8535 ± 0.002632	486 ± 143	9351 ± 545	100
B5	MS-DHC-LOG	0.9116 ± 0.02632	7644 ± 1613	1130 ± 736	0.8704 ± 0.006336	8167 ± 1369	8643 ± 1198	100
B5	MS-NL2SOL-FWD-LOG	0.932 ± 0.02711	69 ± 27	436 ± 435	0.8564 ± 0.0009693	72 ± 18	9809 ± 144	100
B5	PSO-LOG	0.9588 ± 0.004234	19000 ± 27345	2648 ± 3672	0.9018 ± 0.04377	69633 ± 6430	9993 ± 5	89
B5	eSS-FMINCON-ADJ-LIN	0.9104 ± 0.04466	18880 ± 25852	17392 ± 19847	0.9912 ± 0.1876	5409 ± 4220	6555 ± 2494	55
B5	eSS-DHC-LIN	0.9576 ± 0.04938	53907 ± 64592	19594 ± 26611	0.9542 ± 0.06112	25037 ± 9779	6426 ± 2996	70
B5	eSS-NOLOC-LIN	0.9883 ± 0.05212	127603 ± 41243	43381 ± 20207	1.093 ± 0.07666	36404 ± 6969	9877 ± 77	0
B5	eSS-NL2SOL-FWD-LIN	0.9332 ± 0.04945	32442 ± 51366	14561 ± 23202	0.9243 ± 0.05467	15724 ± 12841	5586 ± 3207	80
B5	MS-FMINCON-ADJ-LIN	0.9306 ± 0.04726	811 ± 355	4620 ± 4341	0.938 ± 0.05679	93 ± 292	7879 ± 1757	80
B5	MS-DHC-LIN	0.9237 ± 0.02641	8136 ± 1127	3079 ± 2553	0.8984 ± 0.0231	7509 ± 2055	9287 ± 383	100
B5	MS-NL2SOL-FWD-LIN	0.9148 ± 0.03225	130 ± 50	3958 ± 3388	0.9112 ± 0.04341	160 ± 155	9299 ± 417	90
B5	PSO-LIN	0.9651 ± 0.01771	41540 ± 53843	10593 ± 17766	0.9302 ± 0.07055	55560 ± 18667	9986 ± 18	80

Table S19 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR I; for the vertical view it is MAXT A. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.9856 ± 0.3581	105 ± 0	3 ± 0	0.4238 ± 0.005003	4746 ± 4008	427 ± 197	100
BM1	eSS-DHC-LOG	1.301 ± 0.4465	105 ± 0	3 ± 0	0.5291 ± 0.1708	14455 ± 11258	471 ± 376	100
BM1	eSS-NOLOC-LOG	1.185 ± 0.5412	105 ± 0	3 ± 0	0.4352 ± 0.00509	33917 ± 2662	932 ± 67	100
BM1	eSS-NL2SOL-FWD-LOG	1.185 ± 0.369	107 ± 0	4 ± 0	0.4411 ± 0.008026	2153 ± 2738	625 ± 251	100
BM1	MS-FMINCON-ADJ-LOG	0.4293 ± 0.005495	373 ± 352	122 ± 116	0.4207 ± 0.002796	434 ± 500	869 ± 134	100
BM1	MS-DHC-LOG	1.315 ± 0.8936	8990 ± 8879	368 ± 352	9.84 ± 27	6449 ± 8049	396 ± 345	90
BM1	MS-NL2SOL-FWD-LOG	0.4519 ± 0.03306	76 ± 30	589 ± 352	12.09 ± 36.8	44 ± 32	636 ± 266	90
BM1	PSO-LOG	1.72 ± 0.7838	113 ± 35	9 ± 1	0.4328 ± 0.002669	35300 ± 566	1000 ± 0	100
BM1	eSS-FMINCON-ADJ-LIN	1.516 ± 0.5311	105 ± 0	3 ± 0	0.6322 ± 0.2762	736 ± 351	228 ± 235	100
BM1	eSS-DHC-LIN	1.509 ± 0.4439	105 ± 0	3 ± 0	0.4648 ± 0.02558	24181 ± 11137	606 ± 265	100
BM1	eSS-NOLOC-LIN	1.543 ± 0.2503	105 ± 0	3 ± 0	0.4419 ± 0.00771	35463 ± 4727	950 ± 106	100
BM1	eSS-NL2SOL-FWD-LIN	1.242 ± 0.3434	107 ± 0	4 ± 1	0.4459 ± 0.005198	23126 ± 13579	747 ± 342	100
BM1	MS-FMINCON-ADJ-LIN	0.4338 ± 0.006602	1445 ± 1135	922 ± 765	20.34 ± 49.97	322 ± 322	441 ± 433	60
BM1	MS-DHC-LIN	0.5625 ± 0.104	30608 ± 13383	757 ± 345	13.58 ± 27.47	24370 ± 16289	618 ± 347	80
BM1	MS-NL2SOL-FWD-LIN	1.231 ± 0.7517	12 ± 4	48 ± 16	0.4566 ± 0.01809	9 ± 4	978 ± 14	100
BM1	PSO-LIN	1.521 ± 0.6119	100 ± 0	3 ± 0	0.4441 ± 0.005707	38825 ± 2123	998 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	100
BM3	eSS-DHC-LOG	7.327 ± 1.686	694814 ± 557204	604562 ± 455836	29.84 ± 7.811	81458 ± 33969	77330 ± 33165	0
BM3	eSS-NOLOC-LOG	9.272 ± 2.511	1285975 ± 859357	1048888 ± 665980	31.14 ± 5.522	101116 ± 9414	94093 ± 4858	0
BM3	eSS-NL2SOL-FWD-LOG	5.515 ± 0.9355	321053 ± 144660	332038 ± 131150	27.21 ± 9.305	78164 ± 36188	83812 ± 25470	0
BM3	MS-FMINCON-ADJ-LOG	2.296 ± 0.2765	1841 ± 385	24816 ± 38422	0.9284 ± 0.3105	1221 ± 1229	92019 ± 6980	90
BM3	MS-DHC-LOG	96.59 ± 13.44	2522 ± 852	131850 ± 1624	102.6 ± 14.16	1877 ± 823	98494 ± 1906	0
BM3	MS-NL2SOL-FWD-LOG	106.9 ± 35.43	97 ± 162	135167 ± 3527	115 ± 35.96	43 ± 32	96328 ± 3158	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	47.98 ± 51.98	101867 ± 21857	99964 ± 26	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	123.7 ± 34.77	77470 ± 41096	68606 ± 36348	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	142.2 ± 11.1	98467 ± 14826	86818 ± 13289	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.002705	821 ± 340	131920 ± 1001	215.9 ± 0.002705	146 ± 264	98225 ± 2246	0
BM3	MS-DHC-LIN	125.3 ± 3.495	1469 ± 627	130700 ± 700	127 ± 4.036	910 ± 936	99453 ± 493	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.04384	5 ± 1	130370 ± 300	430.1 ± 0.0431	6 ± 1	99300 ± 924	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	79.58 ± 93.27	105963 ± 14216	99958 ± 30	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.8247 ± 0.3107	12417 ± 31056	1487 ± 1947	0.789 ± 0.3853	14061 ± 13860	2189 ± 962	91
MendesTSP	eSS-DHC-LOG	4.6 ± 5.71	107194 ± 22006	6920 ± 1446	6.107 ± 8.079	48384 ± 10824	3158 ± 716	10
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	12.7 ± 5.926	54265 ± 2850	3584 ± 9	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.511 ± 2.564	18705 ± 31477	1364 ± 2134	1.485 ± 2.572	33250 ± 15160	2423 ± 1059	90
MendesTSP	MS-FMINCON-ADJ-LOG	2.652 ± 2.994	1668 ± 1940	4829 ± 1696	104.1 ± 309.2	362 ± 318	2513 ± 1237	10
MendesTSP	MS-DHC-LOG	13.95 ± 5.542	2806 ± 1069	4758 ± 53	15.13 ± 6.698	1442 ± 1496	3506 ± 48	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	1595 ± 1010	0.7633 ± 0.2003	68 ± 172	3583 ± 13	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	22.08 ± 5.782	54229 ± 1430	3597 ± 2	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	28.96 ± 9.896	17505 ± 11354	2222 ± 1156	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	33.54 ± 5.589	48927 ± 8206	3117 ± 494	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	35.09 ± 3.212	57504 ± 4459	3534 ± 65	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	18.98 ± 14.64	27317 ± 12484	2231 ± 1032	0
MendesTSP	MS-FMINCON-ADJ-LIN	53.58 ± 23.29	221 ± 90	4842 ± 97	54.39 ± 22.71	186 ± 151	3475 ± 106	0
MendesTSP	MS-DHC-LIN	34.23 ± 3.449	1912 ± 1319	4745 ± 66	35.81 ± 4.145	882 ± 566	3547 ± 62	0
MendesTSP	MS-NL2SOL-FWD-LIN	28.83 ± 0	216 ± 192	4698 ± 17	29.14 ± 0.9851	15 ± 16	3576 ± 14	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	33.85 ± 3.05	54167 ± 3294	3595 ± 2	0

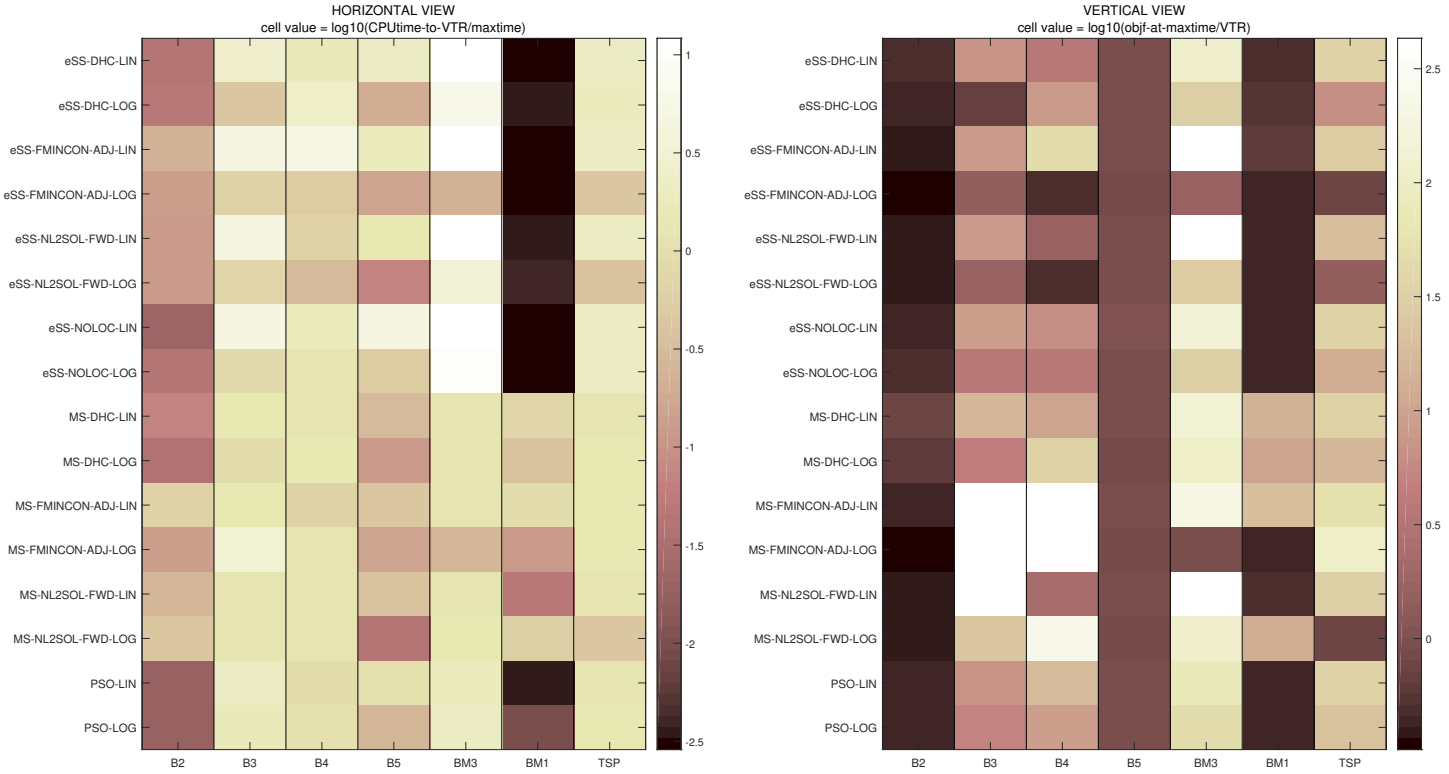

Figure S81: Result summary of horizontal and vertical views with VTR I, MAXT A in Table S1.

4.3.18 VTR I, MAXT B

Table S20: Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR I; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
B2	eSS-FMINCON-ADJ-LOG	0.3606 ± 0.01315	3854 ± 382	1405 ± 585	0.3465 ± 0.01775	16722 ± 12514	2886 ± 1437	100
B2	eSS-DHC-LOG	0.7055 ± 0.1627	14916 ± 3357	472 ± 99	0.504 ± 0.04743	157632 ± 17990	4746 ± 459	100
B2	eSS-NOLOC-LOG	1.025 ± 0.04088	14209 ± 2984	401 ± 87	0.5571 ± 0.05318	200782 ± 48616	4982 ± 10	100
B2	eSS-NL2SOL-FWD-LOG	0.616 ± 0.2608	4170 ± 3418	1257 ± 1026	0.4065 ± 0.06609	18260 ± 11918	2920 ± 1425	100
B2	MS-FMINCON-ADJ-LOG	0.3633 ± 0.07514	2311 ± 1181	2669 ± 3507	0.3493 ± 0.0435	1845 ± 1423	3954 ± 605	90
B2	MS-DHC-LOG	0.779 ± 0.0867	11600 ± 0	418 ± 208	0.6288 ± 0.04262	10440 ± 3668	4892 ± 72	100
B2	MS-NL2SOL-FWD-LOG	0.5055 ± 0.1848	203 ± 140	1663 ± 2017	0.3743 ± 0.01805	106 ± 157	4570 ± 438	90
B2	PSO-LOG	1.065 ± 0.01158	8330 ± 6076	178 ± 114	0.5001 ± 0.07081	245190 ± 17851	4999 ± 1	100
B2	eSS-FMINCON-ADJ-LIN	0.5669 ± 0.291	7122 ± 3273	2420 ± 2102	1.648 ± 2.476	9980 ± 9699	2076 ± 1736	80
B2	eSS-DHC-LIN	0.7784 ± 0.1043	20783 ± 12365	426 ± 258	0.5527 ± 0.04316	221253 ± 47741	4298 ± 915	100
B2	eSS-NOLOC-LIN	1.031 ± 0.0239	14745 ± 2928	228 ± 43	0.4971 ± 0.04115	342331 ± 7168	4962 ± 60	100
B2	eSS-NL2SOL-FWD-LIN	0.575 ± 0.2418	10648 ± 9120	1131 ± 707	0.4283 ± 0.1383	29036 ± 23051	2336 ± 954	100
B2	MS-FMINCON-ADJ-LIN	0.5 ± 0.2532	4712 ± 2176	4531 ± 2735	0.7701 ± 0.7475	1761 ± 1683	3484 ± 1506	60
B2	MS-DHC-LIN	0.9171 ± 0.09758	11600 ± 0	1767 ± 2719	0.7817 ± 0.04931	9111 ± 4830	4829 ± 93	80
B2	MS-NL2SOL-FWD-LIN	0.6133 ± 0.1674	533 ± 552	2563 ± 3043	0.4438 ± 0.04447	216 ± 468	4370 ± 804	80
B2	PSO-LIN	1.053 ± 0.01864	9170 ± 6566	198 ± 133	0.4792 ± 0.04758	238638 ± 8777	4999 ± 1	100
B3	eSS-FMINCON-ADJ-LOG	4.291 ± 0.4217	8877 ± 2060	66925 ± 33950	5.149 ± 1.485	6933 ± 5423	42033 ± 8970	10
B3	eSS-DHC-LOG	1.425 ± 0.8279	22934 ± 10973	44370 ± 20786	3.171 ± 2.7	12899 ± 9101	27583 ± 12411	70
B3	eSS-NOLOC-LOG	4.205 ± 0.2958	8090 ± 3479	85945 ± 34738	5.936 ± 1.565	2263 ± 618	34663 ± 10644	10
B3	eSS-NL2SOL-FWD-LOG	4.162 ± 0.2939	9257 ± 1646	71176 ± 24122	5.33 ± 0.9225	5375 ± 3211	41446 ± 11044	30
B3	MS-FMINCON-ADJ-LOG	2.485e+11 ± 4.305e+11	175 ± 215	194526 ± 151129	2.298e+25 ± 3.98e+25	1 ± 0	21493 ± 19921	10
B3	MS-DHC-LOG	4.502 ± 0.08198	3463 ± 5523	60134 ± 16730	4.502 ± 0.08198	301 ± 537	47198 ± 4740	20
B3	MS-NL2SOL-FWD-LOG	23.35 ± 0	4 ± 0	65594 ± 538	23.35 ± 0	4 ± 0	49754 ± 198	0
B3	PSO-LOG	5.204 ± 0.7323	15430 ± 5994	151887 ± 49851	6.429 ± 0.4846	5190 ± 915	49383 ± 477	0
B3	eSS-FMINCON-ADJ-LIN	4.772 ± 0.7458	59988 ± 31199	467680 ± 165546	10.92 ± 3.27	4138 ± 1323	37924 ± 8582	0
B3	eSS-DHC-LIN	4.275 ± 0.7195	50990 ± 20838	288666 ± 199146	12.67 ± 14.03	6416 ± 6249	34505 ± 9778	10
B3	eSS-NOLOC-LIN	4.967 ± 0.8438	64515 ± 13536	438396 ± 183389	12.7 ± 3.068	4424 ± 1306	40659 ± 8101	0
B3	eSS-NL2SOL-FWD-LIN	4.938 ± 0.6057	58876 ± 21218	472648 ± 172728	11.2 ± 4.929	3844 ± 1327	38442 ± 12106	0
B3	MS-FMINCON-ADJ-LIN	1.515e+10 ± 2.545e+10	1 ± 0	68483 ± 3165	1.515e+10 ± 2.545e+10	1 ± 0	48001 ± 1659	0
B3	MS-DHC-LIN	16.04 ± 0.004056	261 ± 335	67424 ± 3783	16.04 ± 0.004056	7 ± 19	46613 ± 3679	0
B3	MS-NL2SOL-FWD-LIN	1.195e+08 ± 0	4 ± 0	65169 ± 169	1.195e+08 ± 0	4 ± 0	49779 ± 258	0
B3	PSO-LIN	6.057 ± 1.496	33060 ± 24311	211327 ± 52441	8.236 ± 1.358	4980 ± 2426	48802 ± 1676	0
B4	eSS-FMINCON-ADJ-LOG	0.07667 ± 0.04622	16543 ± 13846	4676 ± 2903	2799 ± 6064	9828 ± 7412	2217 ± 1677	60
B4	eSS-DHC-LOG	3.932 ± 2.105	1034979 ± 457465	22387 ± 9509	11.67 ± 7.009	143501 ± 51549	3352 ± 1110	0
B4	eSS-NOLOC-LOG	2.195 ± 0.6907	644297 ± 418381	11886 ± 6951	12.47 ± 8.968	262878 ± 17654	4949 ± 51	0
B4	eSS-NL2SOL-FWD-LOG	0.813 ± 0.6993	124050 ± 175568	2877 ± 4070	1.768 ± 3.602	160078 ± 52478	3756 ± 1167	80
B4	MS-FMINCON-ADJ-LOG	0.2503 ± 0.3914	3844 ± 5461	10130 ± 7468	16.71 ± 36.7	337 ± 692	2370 ± 1501	40
B4	MS-DHC-LOG	557.8 ± 1163	10084 ± 3498	6895 ± 385	566.5 ± 1158	4061 ± 5246	4753 ± 212	0
B4	MS-NL2SOL-FWD-LOG	239.1 ± 6.287e-14	179 ± 258	6529 ± 20	239.1 ± 6.287e-14	60 ± 173	4982 ± 16	0
B4	PSO-LOG	19.4 ± 34.74	392250 ± 274359	11489 ± 7743	13.76 ± 6.467	178089 ± 35698	4998 ± 1	0
B4	eSS-FMINCON-ADJ-LIN	6.689 ± 7.371	745367 ± 301766	50083 ± 11123	57.08 ± 36.88	16297 ± 14728	3282 ± 1153	0
B4	eSS-DHC-LIN	1.501 ± 0.5449	982524 ± 462128	16582 ± 10383	6.362 ± 3.911	224183 ± 90148	3620 ± 1407	10
B4	eSS-NOLOC-LIN	1.997 ± 0.1256	1148592 ± 480112	17744 ± 6632	24.42 ± 9.034	309658 ± 13070	4933 ± 67	0
B4	eSS-NL2SOL-FWD-LIN	1.343 ± 0.5434	395551 ± 258107	6866 ± 4424	8.262 ± 8.624	220514 ± 65989	3806 ± 1050	40
B4	MS-FMINCON-ADJ-LIN	0.2125 ± 0.2626	4068 ± 5466	5455 ± 4410	1.385e+04 ± 3.312e+04	432 ± 437	1618 ± 1604	60
B4	MS-DHC-LIN	12.52 ± 3.604	9732 ± 4161	6620 ± 84	12.52 ± 3.604	3085 ± 4595	4902 ± 76	0
B4	MS-NL2SOL-FWD-LIN	2.382 ± 0	180 ± 258	6521 ± 10	2.382 ± 0	118 ± 229	4990 ± 8	0
B4	PSO-LIN	40.76 ± 70.18	424950 ± 433263	9342 ± 9446	30.73 ± 31.5	234950 ± 31011	4999 ± 1	0
B5	eSS-FMINCON-ADJ-LOG	0.889 ± 0.03808	2223 ± 99	1599 ± 478	0.8842 ± 0.03406	11272 ± 8134	3330 ± 1319	100
B5	eSS-DHC-LOG	0.91 ± 0.03496	10620 ± 876	1927 ± 311	0.9042 ± 0.03425	20597 ± 8038	3723 ± 1220	100
B5	eSS-NOLOC-LOG	0.9582 ± 0.003527	26590 ± 7970	4988 ± 1937	0.9489 ± 0.03492	27010 ± 5485	4913 ± 63	60
B5	eSS-NL2SOL-FWD-LOG	0.9228 ± 0.03633	1843 ± 12	746 ± 161	0.9132 ± 0.04098	18173 ± 5341	4105 ± 858	100
B5	MS-FMINCON-ADJ-LOG	0.8892 ± 0.03991	545 ± 178	1963 ± 1115	0.8561 ± 0.004511	546 ± 125	4322 ± 407	100
B5	MS-DHC-LOG	0.9256 ± 0.03416	6379 ± 2152	738 ± 290	0.8803 ± 0.02246	7650 ± 1628	4316 ± 427	100
B5	MS-NL2SOL-FWD-LOG	0.9081 ± 0.03749	79 ± 26	425 ± 193	0.8594 ± 0.004863	74 ± 26	4789 ± 180	100
B5	PSO-LOG	0.9588 ± 0.004234	19000 ± 27345	2648 ± 3672	0.9094 ± 0.04329	35870 ± 3672	4994 ± 5	90
B5	eSS-FMINCON-ADJ-LIN	0.9104 ± 0.04466	18880 ± 25852	17392 ± 19847	1.446 ± 0.4433	2154 ± 501	1836 ± 1703	25
B5	eSS-DHC-LIN	0.9576 ± 0.04938	53907 ± 64592	19594 ± 26611	0.9803 ± 0.08031	12613 ± 6666	2935 ± 1033	60
B5	eSS-NOLOC-LIN	0.9883 ± 0.05212	127603 ± 41243	43381 ± 20207	1.194 ± 0.06543	16987 ± 1462	4820 ± 137	0
B5	eSS-NL2SOL-FWD-LIN	0.9332 ± 0.04945	32442 ± 51366	14561 ± 23202	0.9671 ± 0.09456	7565 ± 4966	3157 ± 1550	60
B5	MS-FMINCON-ADJ-LIN	0.9718 ± 0.07212	1057 ± 658	5256 ± 3704	1.012 ± 0.08305	1 ± 0	4066 ± 877	50
B5	MS-DHC-LIN	0.9266 ± 0.03206	8487 ± 358	3350 ± 1731	0.9274 ± 0.05456	8174 ± 1013	4066 ± 628	80
B5	MS-NL2SOL-FWD-LIN	0.9262 ± 0.02789	160 ± 71	2461 ± 1711	0.9161 ± 0.03134	168 ± 35	4416 ± 512	90
B5	PSO-LIN	0.9651 ± 0.01771	41540 ± 53843	10593 ± 17766	0.9498 ± 0.08527	28440 ± 8611	4993 ± 5	70

Table S20 (continued): Performance analysis of the methods from horizontal and vertical views, for benchmarks B2, B3, B4, and B5. For the horizontal view, the stopping criterion is VTR I; for the vertical view it is MAXT B. MAXT and VTR are given in Table S1 for each benchmark. Objective function values (*fbest, std*) are divided by the VTR of each benchmark; values larger than one mean unsuccessful runs.

		Horizontal view			Vertical view			
Benchmark	Method	mean fbest ± std	mean evals ± std	mean time ± std	mean fbest ± std	mean evals ± std	mean time ± std	hits %
BM1	eSS-FMINCON-ADJ-LOG	0.9856 ± 0.3581	105 ± 0	3 ± 0	0.4291 ± 0.008539	3333 ± 2764	283 ± 153	100
BM1	eSS-DHC-LOG	1.301 ± 0.4465	105 ± 0	3 ± 0	0.5475 ± 0.1674	5351 ± 5735	163 ± 173	100
BM1	eSS-NOLOC-LOG	1.185 ± 0.5412	105 ± 0	3 ± 0	0.4413 ± 0.005778	16178 ± 2489	445 ± 62	100
BM1	eSS-NL2SOL-FWD-LOG	1.185 ± 0.369	107 ± 0	4 ± 0	0.5228 ± 0.0997	773 ± 741	176 ± 183	100
BM1	MS-FMINCON-ADJ-LOG	0.4285 ± 0.007952	466 ± 350	149 ± 115	0.4217 ± 0.003815	370 ± 237	381 ± 92	100
BM1	MS-DHC-LOG	1.297 ± 0.8446	11371 ± 12890	454 ± 487	29.88 ± 60.84	3571 ± 4656	220 ± 188	70
BM1	MS-NL2SOL-FWD-LOG	0.4482 ± 0.03473	68 ± 28	611 ± 342	85.38 ± 131.2	12 ± 21	126 ± 176	30
BM1	PSO-LOG	1.72 ± 0.7838	113 ± 35	9 ± 1	0.4424 ± 0.006082	16450 ± 794	499 ± 1	100
BM1	eSS-FMINCON-ADJ-LIN	1.516 ± 0.5311	105 ± 0	3 ± 0	0.6407 ± 0.2708	658 ± 294	160 ± 176	100
BM1	eSS-DHC-LIN	1.509 ± 0.4439	105 ± 0	3 ± 0	0.7445 ± 0.2773	5440 ± 7080	139 ± 178	100
BM1	eSS-NOLOC-LIN	1.543 ± 0.2503	105 ± 0	3 ± 0	0.4468 ± 0.005988	17679 ± 1706	475 ± 32	100
BM1	eSS-NL2SOL-FWD-LIN	1.242 ± 0.3434	107 ± 0	4 ± 1	0.4469 ± 0.005545	8565 ± 4669	329 ± 123	100
BM1	MS-FMINCON-ADJ-LIN	0.4372 ± 0.007112	1108 ± 1117	736 ± 796	21.52 ± 49.73	300 ± 293	182 ± 182	60
BM1	MS-DHC-LIN	0.7348 ± 0.214	15354 ± 14647	382 ± 386	9.56 ± 19.85	4233 ± 5527	133 ± 134	60
BM1	MS-NL2SOL-FWD-LIN	1.674 ± 1.077	11 ± 6	40 ± 22	0.4922 ± 0.07692	12 ± 6	479 ± 20	100
BM1	PSO-LIN	1.521 ± 0.6119	100 ± 0	3 ± 0	0.4481 ± 0.01254	19800 ± 1207	499 ± 1	100
BM3	eSS-FMINCON-ADJ-LOG	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	1.609 ± 0.7511	12535 ± 511	24213 ± 4472	100
BM3	eSS-DHC-LOG	7.327 ± 1.686	694814 ± 557204	604562 ± 455836	43.97 ± 18.39	34437 ± 19383	30736 ± 18333	0
BM3	eSS-NOLOC-LOG	9.272 ± 2.511	1285975 ± 859357	1048888 ± 665980	56.96 ± 4.977	50100 ± 3166	44620 ± 3343	0
BM3	eSS-NL2SOL-FWD-LOG	5.515 ± 0.9355	321053 ± 144660	332038 ± 131150	49.87 ± 23.37	32141 ± 18492	38659 ± 9609	0
BM3	MS-FMINCON-ADJ-LOG	2.12 ± 0.3137	2002 ± 555	12927 ± 5426	1.405 ± 0.5577	1601 ± 1208	42922 ± 7216	100
BM3	MS-DHC-LOG	102.6 ± 14.16	2211 ± 837	66626 ± 1160	109.8 ± 20.83	1178 ± 842	48005 ± 1552	0
BM3	MS-NL2SOL-FWD-LOG	131.4 ± 50.56	154 ± 212	68695 ± 3893	150 ± 54.52	28 ± 26	45446 ± 3563	0
BM3	PSO-LOG	44.25 ± 39.35	213775 ± 87467	211579 ± 95360	49.44 ± 44.23	55075 ± 12820	49940 ± 40	0
BM3	eSS-DHC-LIN	23.31 ± 7.524	1327038 ± 57400	1213728 ± 2249	132.8 ± 37.41	31325 ± 17221	27790 ± 15466	0
BM3	eSS-NOLOC-LIN	36.28 ± 13.73	1352523 ± 28796	1213921 ± 1983	166.8 ± 24.36	44879 ± 10609	39779 ± 9165	0
BM3	MS-FMINCON-ADJ-LIN	215.9 ± 0.01713	601 ± 437	66740 ± 2206	215.9 ± 0.01713	176 ± 355	48827 ± 1457	0
BM3	MS-DHC-LIN	136.1 ± 21.16	1245 ± 791	65402 ± 396	136.1 ± 21.16	746 ± 769	49150 ± 837	0
BM3	MS-NL2SOL-FWD-LIN	430.1 ± 0.06654	6 ± 3	65356 ± 149	430.1 ± 0.06779	6 ± 2	49248 ± 770	0
BM3	PSO-LIN	79.41 ± 86.66	208910 ± 91689	194224 ± 75110	90.69 ± 81.29	52000 ± 5883	49934 ± 27	0
MendesTSP	eSS-FMINCON-ADJ-LOG	0.8247 ± 0.3107	12417 ± 31056	1487 ± 1947	0.9171 ± 0.4893	5537 ± 4123	1141 ± 366	82
MendesTSP	eSS-DHC-LOG	4.6 ± 5.71	107194 ± 22006	6920 ± 1446	7.88 ± 8.783	21228 ± 5188	1389 ± 335	0
MendesTSP	eSS-NOLOC-LOG	9.013 ± 4.971	110466 ± 6075	7211 ± 5	18.99 ± 8.192	26499 ± 1611	1776 ± 37	0
MendesTSP	eSS-NL2SOL-FWD-LOG	1.511 ± 2.564	18705 ± 31477	1364 ± 2134	1.518 ± 2.562	16140 ± 8294	1180 ± 556	80
MendesTSP	MS-FMINCON-ADJ-LOG	4.568 ± 4.482	2035 ± 2360	3237 ± 1607	12.85 ± 17.1	452 ± 388	1119 ± 499	10
MendesTSP	MS-DHC-LOG	17.73 ± 5.781	3007 ± 956	2428 ± 60	21.3 ± 6.91	2282 ± 1462	1684 ± 94	0
MendesTSP	MS-NL2SOL-FWD-LOG	0.7 ± 1.23e-16	126 ± 0	902 ± 721	0.7633 ± 0.2003	72 ± 170	1785 ± 9	90
MendesTSP	PSO-LOG	20.4 ± 12.68	82870 ± 33651	5401 ± 2169	32.79 ± 6.262	27040 ± 800	1796 ± 3	0
MendesTSP	eSS-FMINCON-ADJ-LIN	23.69 ± 8.042	55727 ± 10940	7449 ± 174	32.84 ± 11.08	11246 ± 5959	1399 ± 392	0
MendesTSP	eSS-DHC-LIN	29.68 ± 5.309	114041 ± 4584	7306 ± 110	39.09 ± 5.289	26263 ± 3205	1675 ± 177	0
MendesTSP	eSS-NOLOC-LIN	30.06 ± 4.246	116770 ± 9096	7210 ± 8	39.88 ± 3.808	29006 ± 1975	1780 ± 27	0
MendesTSP	eSS-NL2SOL-FWD-LIN	13.96 ± 14.7	87418 ± 7337	7232 ± 18	26.69 ± 14.98	11558 ± 6601	944 ± 553	0
MendesTSP	MS-FMINCON-ADJ-LIN	68.87 ± 28.48	333 ± 177	2608 ± 223	77.28 ± 27.89	204 ± 118	1698 ± 91	0
MendesTSP	MS-DHC-LIN	35.9 ± 4.32	1790 ± 1263	2385 ± 45	37.82 ± 4.783	943 ± 303	1747 ± 33	0
MendesTSP	MS-NL2SOL-FWD-LIN	29.76 ± 1.505	198 ± 202	2352 ± 9	29.76 ± 1.505	13 ± 24	1784 ± 18	0
MendesTSP	PSO-LIN	36.41 ± 5.398	63450 ± 36870	4192 ± 2380	38.97 ± 3.512	27278 ± 1280	1798 ± 1	0

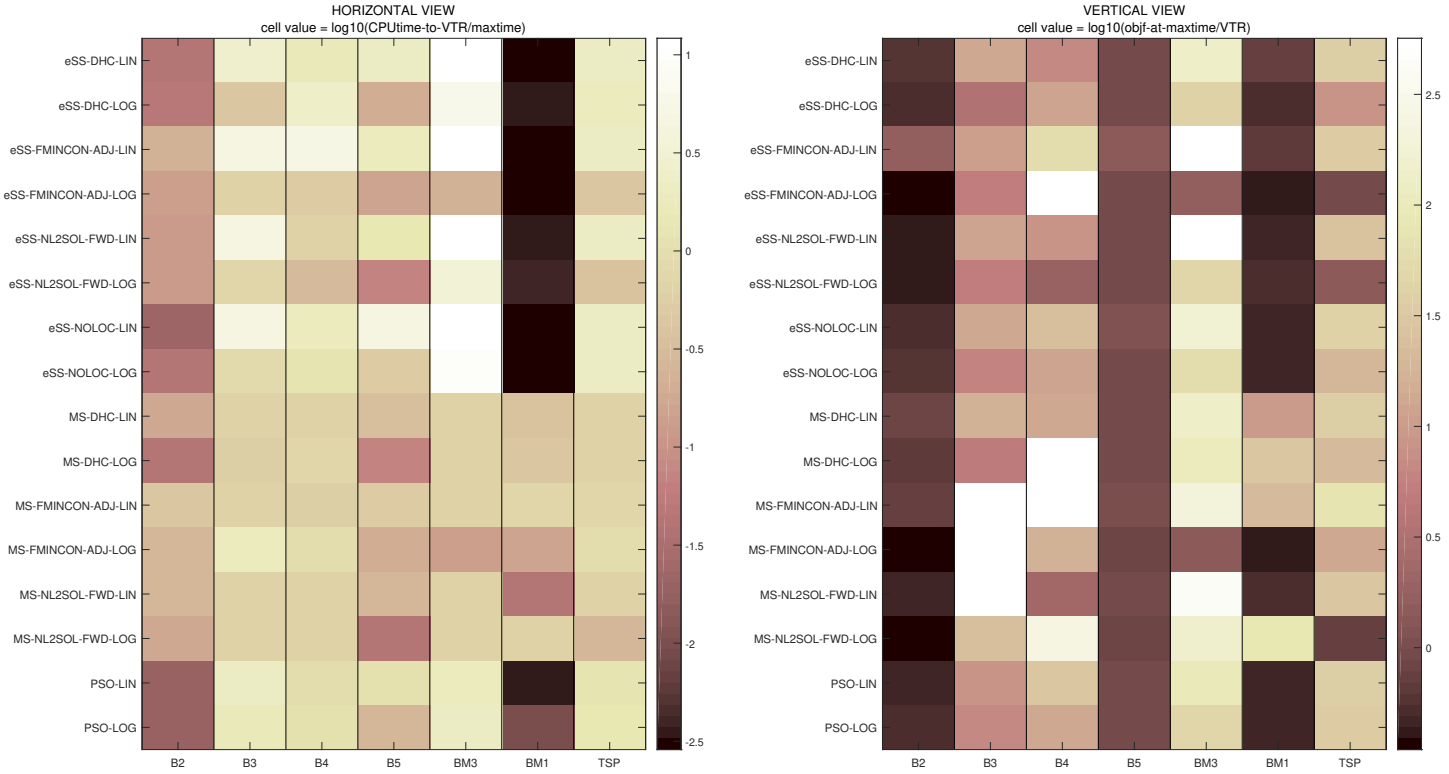

Figure S82: Result summary of horizontal and vertical views with VTR I, MAXT B in Table S1.

4.4 Average improvements in OE due to different factors

Table S21: Average improvements in overall efficiency (OE) for all benchmarks and methods due to the following factors: gradient-based versus gradient-free methods (grad/no grad), enhanced scatter search versus multistart (eSS/MS), logarithmic versus linear scaling for the parameters (LOG/LIN). The table shows results for all the thresholds (VTR and MAXT) considered in this study, as well as for the average across all VTRs and MAXTs in the last row.

VTR	MAXT	grad/no grad	eSS/MS	LOG/LIN
A	A	1.74115	2.83188	2.77956
B	A	1.13731	3.53098	2.64666
C	A	1.23136	2.10283	3.27325
D	A	1.07242	2.65302	1.96132
E	A	9.78953	1.12343	9.24334
F	A	7.163	1.36291	7.72497
G	A	2.91416	1.59207	6.85481
H	A	3.09924	1.93999	6.18019
I	A	1.15453	2.73795	2.16391
A	B	1.74719	2.90902	2.56289
B	B	1.02163	3.02574	2.51486
C	B	1.17085	1.8866	3.1288
D	B	1.07701	2.47335	1.92279
E	B	11.0165	1.67272	206.828
F	B	5.6348	2.44562	28.0415
G	B	2.717	1.56062	7.00088
H	B	2.96439	2.06067	5.39477
I	B	1.08875	2.45622	2.04025
Average		3.20782	2.24253	16.7924

5 Appendix: adjoint vs forward sensitivities

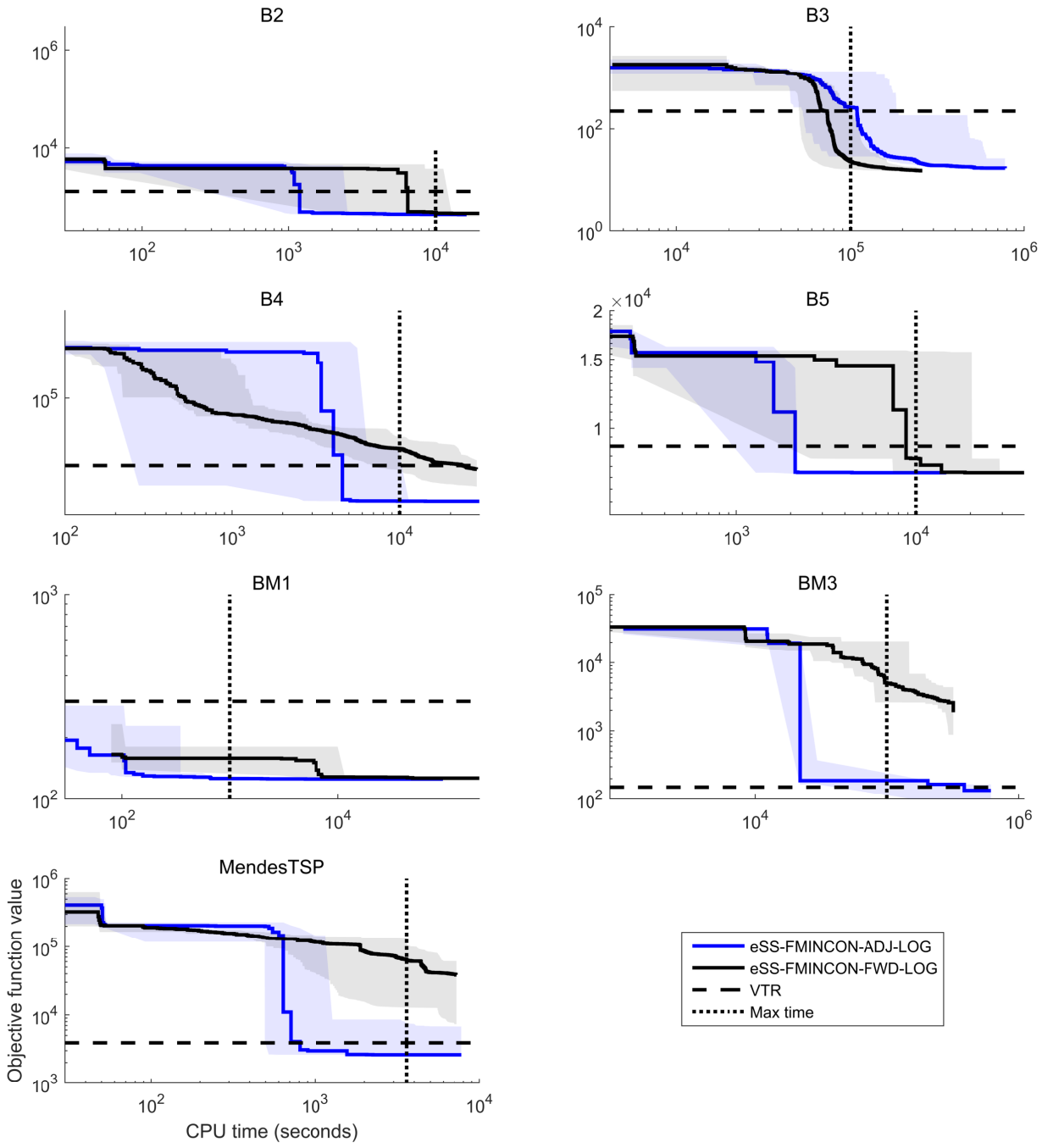

Figure S83: Convergence curves of eSS-FMINCON-ADJ-LOG and eSS-FMINCON-FWD-LOG.