Table S1: Results for the modified Turek-Hron benchmark with different IB and B-spline kernels and various values of M_{FAC} at a Cartesian resolution of $N = 64$.

	$M_{\text{FAC}} = 0.5$		$M_{\text{FAC}} = 1.0$		$M_{\text{FAC}} = 2.0$		$M_{\text{FAC}} = 4.0$	
Kernel	A_x ($\times 10^{-3}$)	St_x	A_x ($\times 10^{-3}$)	St_x	A_x ($\times 10^{-3}$)	St_x	A_x ($\times 10^{-3}$)	St_x
IB (3-point)	-2.03 ± 1.97	10.4	-2.69 ± 2.54	10.4	-2.76 ± 2.65	10.8	-3.02 ± 2.87	10.8
IB (4-point)	-1.55 ± 1.56	10.4	-2.51 ± 2.39	10.4	-2.69 ± 2.58	10.8	-2.94 ± 2.80	10.8
IB (5-point)	-2.51 ± 2.38	10.4	-2.57 ± 2.44	10.4	-2.70 ± 2.60	10.8	-2.95 ± 2.81	10.8
IB (6-point)	-2.46 ± 2.35	10.4	-2.48 ± 2.36	10.4	-2.65 ± 2.53	10.4	-2.89 ± 2.75	10.8
B-spline (3-point)	-2.57 ± 2.44	10.8	-2.69 ± 2.55	10.8	-2.76 ± 2.66	10.8	-3.03 ± 2.89	10.8
B-spline (4-point)	-2.53 ± 2.42	10.4	-2.67 ± 2.54	10.4	-2.74 ± 2.63	10.8	-3.00 ± 2.86	10.8
B-spline (5-point)	-2.55 ± 2.43	10.4	-2.63 ± 2.50	10.8	-2.72 ± 2.62	10.8	-2.98 ± 2.84	10.8
B-spline (6-point)	-2.54 ± 2.42	10.4	-2.58 ± 2.46	10.4	-2.70 ± 2.60	10.8	-2.96 ± 2.82	10.8
Kernel	A_y ($\times 10^{-3}$)	St_y	A_y ($\times 10^{-3}$)	St_y	A_y ($\times 10^{-3}$)	St_y	A_y ($\times 10^{-3}$)	St_y
IB (3-point)	1.37 ± 29.2	5.00	1.45 ± 33.3	5.00	1.42 ± 34.1	5.00	1.48 ± 35.2	5.00
IB (4-point)	1.04 ± 25.9	5.00	1.46 ± 32.2	5.00	1.41 ± 33.5	5.00	1.47 ± 34.6	5.00
IB (5-point)	1.39 ± 32.2	5.00	1.48 ± 32.6	5.00	1.41 ± 33.6	5.00	1.48 ± 34.7	5.00
IB (6-point)	1.39 ± 31.9	5.00	1.44 ± 32.0	5.00	1.41 ± 33.2	5.00	1.47 ± 34.3	5.00
B-spline (3-point)	1.41 ± 32.7	5.00	1.44 ± 33.4	5.00	1.41 ± 34.2	5.00	1.49 ± 35.3	5.00
B-spline (4-point)	1.41 ± 32.5	5.00	1.46 ± 33.3	5.00	1.42 ± 34.0	5.00	1.48 ± 35.1	5.00
B-spline (5-point)	1.39 ± 32.5	5.00	1.48 ± 33.0	5.00	1.42 ± 33.8	5.00	1.48 ± 34.9	5.00
B-spline (6-point)	1.41 ± 32.4	5.00	1.48 ± 32.6	5.00	1.41 ± 33.7	5.00	1.48 ± 34.8	5.00

Appendix

A Turek-Hron Benchmark Results for Various Choices of Kernel Function

This section details results for the modified Turek-Hron benchmark using various IB and B-spline kernels (see Figures S1 and S2). Table S1 reports the means for A_x and A_y, which are x-, y-displacements of the point A, as well as the Strouhal numbers corresponding to the oscillations of A_x and A_y at periodic steady-state. Here we look at relatively coarser resolution cases, in which the number of grid cells on coarsest grid level is $N = 64$. These results indicate that the three-point B-spline kernel is the only kernel that shows consistent Strouhal numbers for all values of $M_{\text{FAC}} = 0.5$, 1, 2, and 4 at $N = 64$, and that it is less sensitive to changes in M_{FAC}. Other kernels show loss of accuracy as we refine the Lagrangian mesh for a fixed Eulerian grid that is relatively coarse.

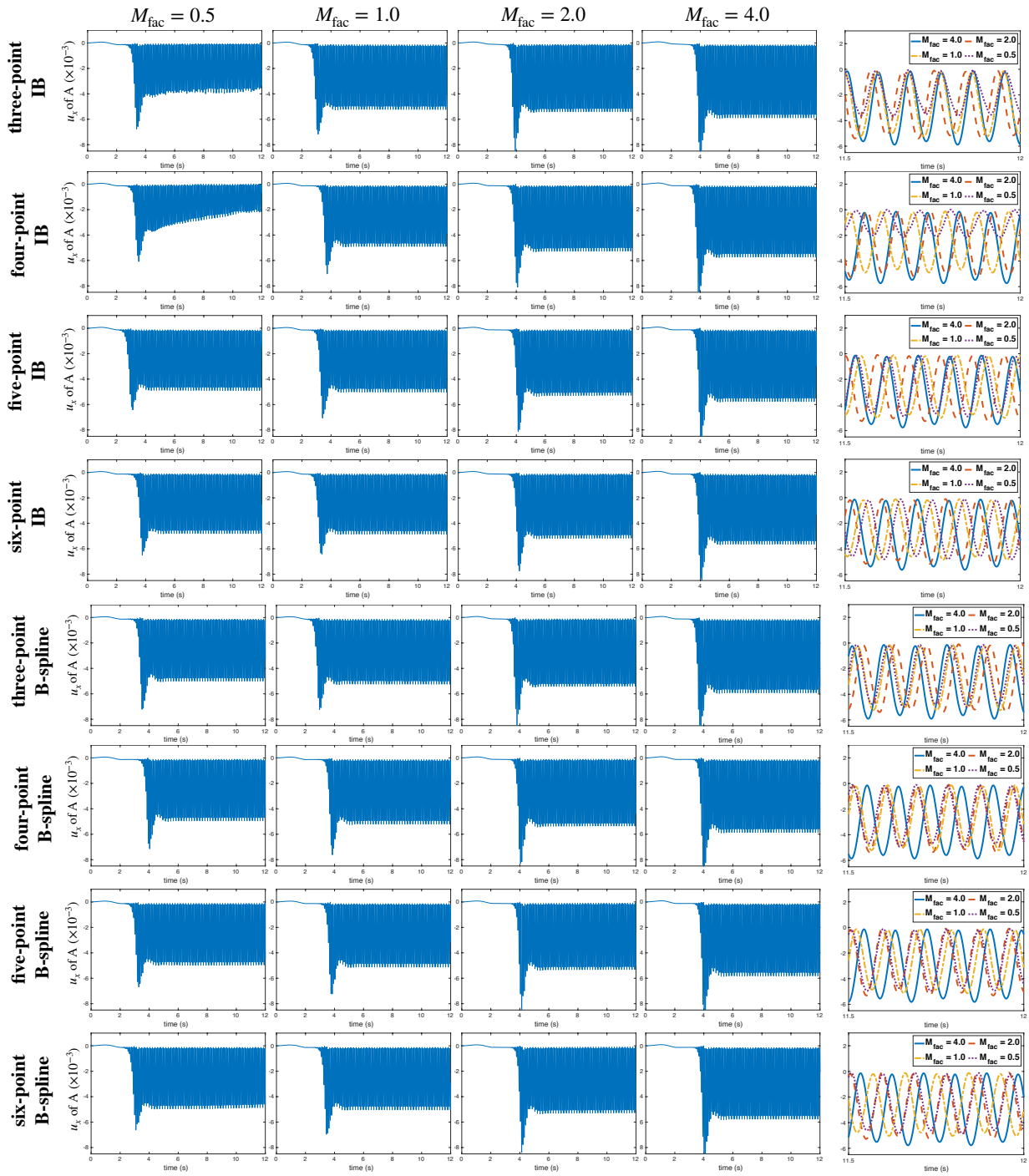

Figure S1: x-displacement (A_x) of the point A for different values of M_{FAC} for the modified Turek-Hron benchmark using different IB and B-spline kernels at a Cartesian resolution of $N = 64$. Figures in the rightmost panels show the periodic oscillations between $t = 11.5$ and $t = 12$.

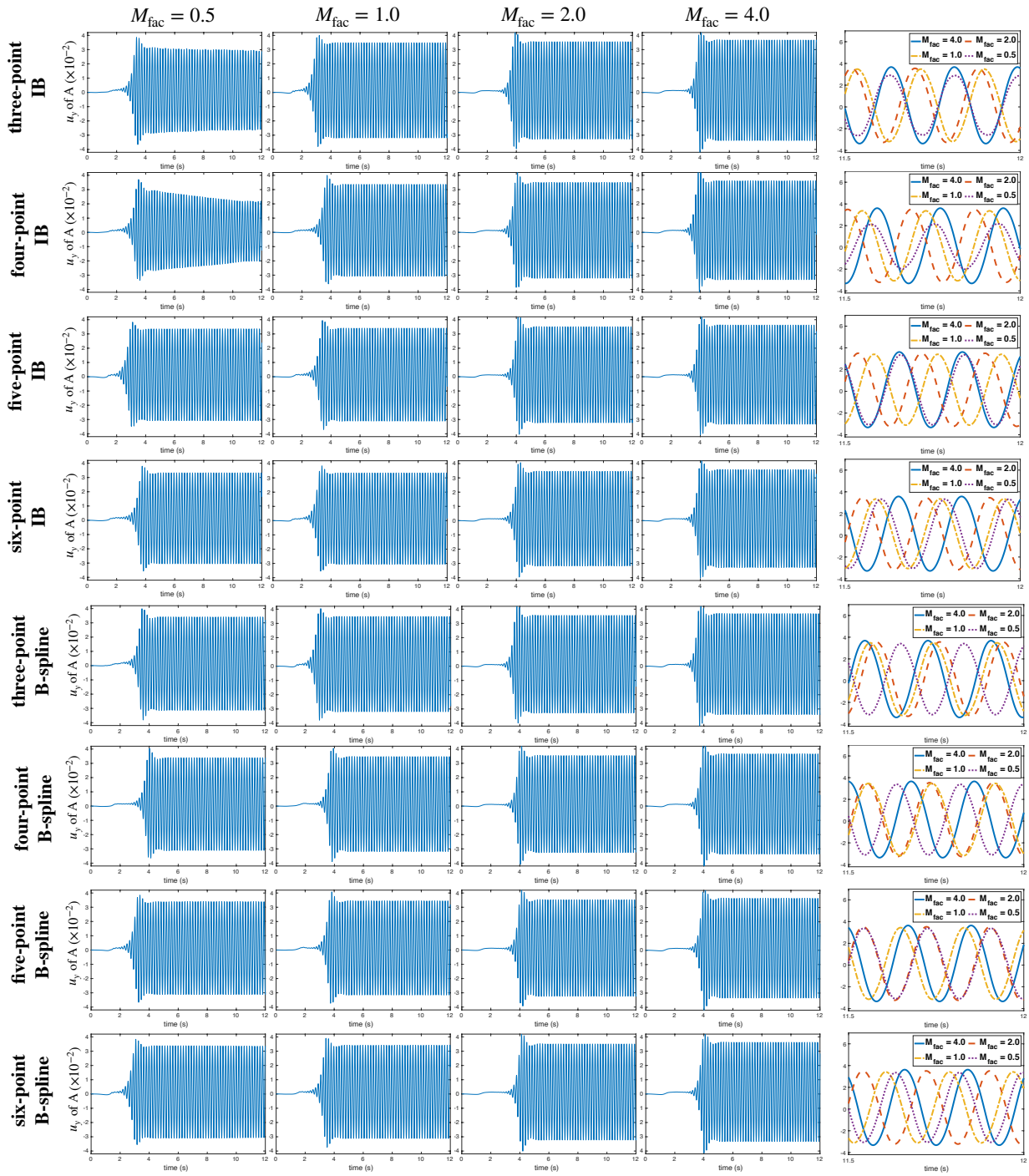

Figure S2: y-displacement (A_y) of the point A for different values of M_{FAC} for the modified Turek-Hron benchmark using different IB and B-spline kernels at a Cartesian resolution of $N = 64$. Figures in the rightmost panels show the periodic oscillations between $t = 11.5$ and $t = 12$.