Supporting Information

Astley et al. 10.1073/pnas.1418965112

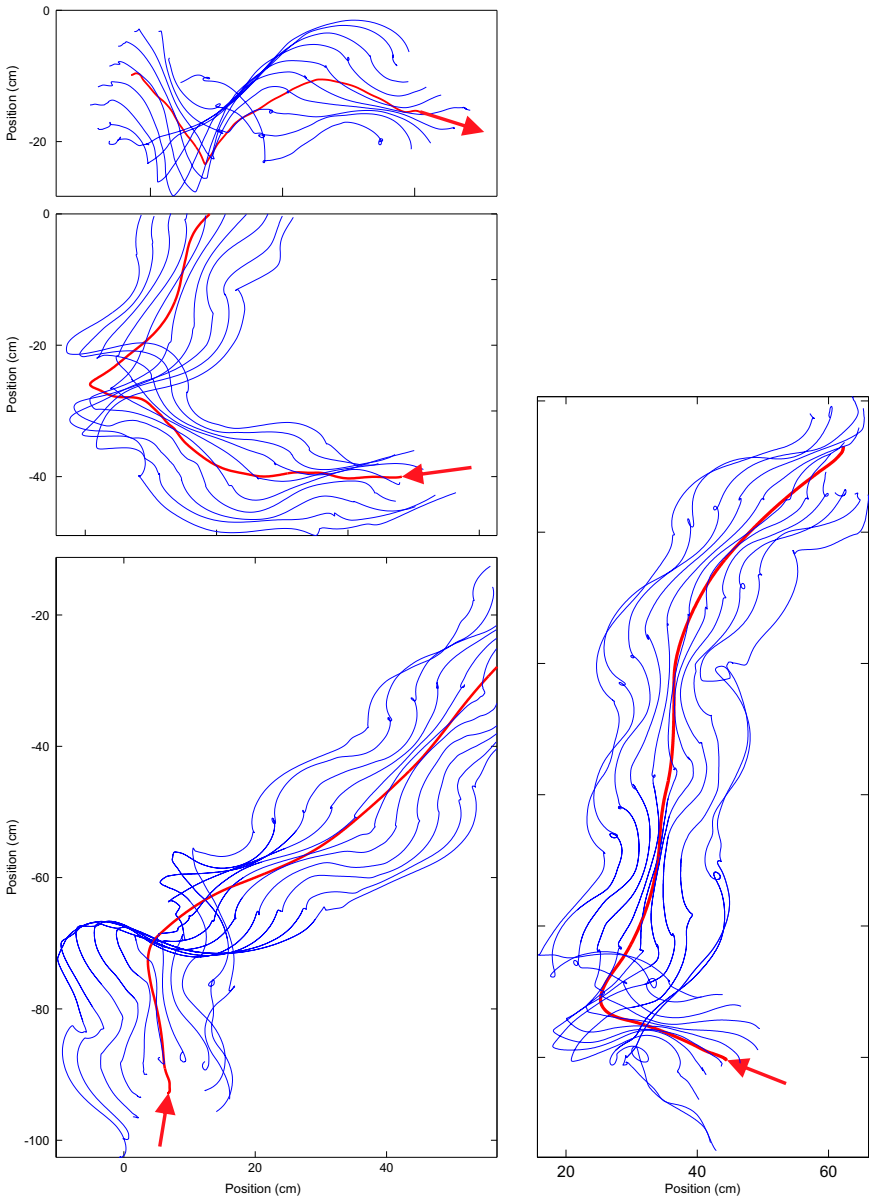


Fig. S1. Sample movement sequences containing both reversal and differential turns. Red lines indicate the path of the center of mass and blue lines indicate the path of points along the body, as in Fig. 2 of the main text.

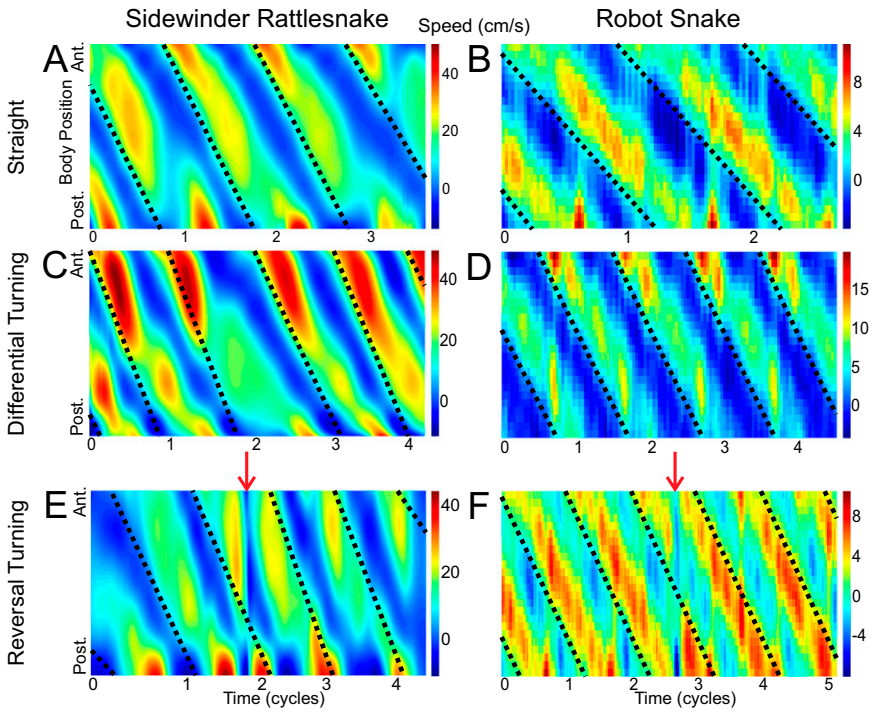


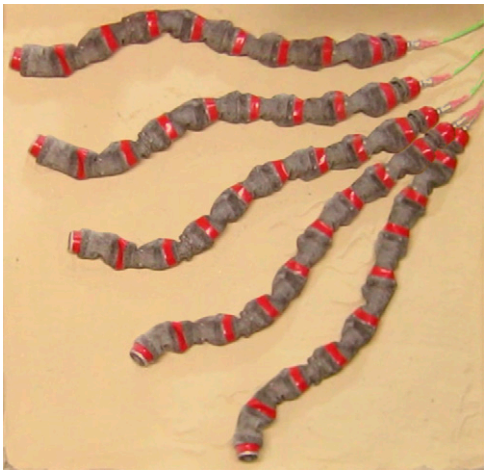
Fig. S2. Space–time speed intensity plots of sidewinding. In each image, color corresponds to the component of velocity parallel to the center of mass velocity. The vertical axis represents the length of the body, with anterior at the top and posterior at the bottom. In snakes, the most anterior point is approximately one-fourth of the snake's length away from the head, whereas the posterior-most point is at the base of the rattle. In robots, the entire length of the robot is shown. The horizontal axis is time, from left to right, expressed in cycles. Black dashed lines indicate the times of maximum body curvature. The occurrence of the high-velocity movement before or after the time of maximum curvature indicates a vertical wave phase offset of positive or negative 90° and the head on the left or right, respectively. (*A*) Straight sidewinding in the snake (0.65 Hz). (*B*) Straight sidewinding in the robot (0.14 Hz). (*C*) Differential turning in a snake (0.87 Hz). (*D*) Differential turning in the robot (0.24 Hz). (*E*) A reversal turn of the snake (0.50 Hz) and (*F*) the robot (0.14 Hz). In both *E* and *F* the instant of reversal turning is indicated by the red arrow.

Movie S1. A sidewinder rattlesnake performing multiple cycles of differential turning.

Movie S1

Movie S2. A sidewinder rattlesnake performing a reversal turn.

Movie S2

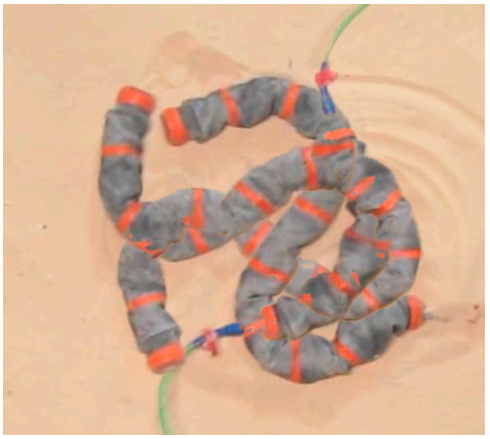


Movie S3. The snake robot performing differential turning in a sand bed due to an amplitude gradient in the horizontal wave.

Movie S3

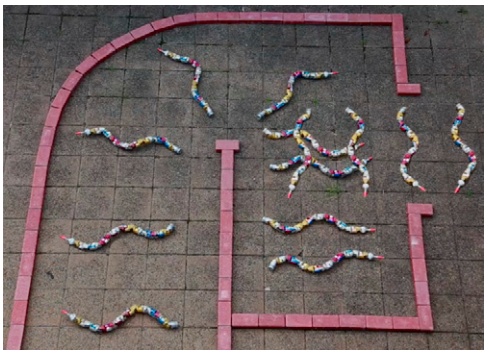
Movie S4. The snake robot performing reversal turning in a sand bed due to a 180° phase shift in the vertical wave.

Movie S4



Movie S5. The snake robot performing frequency turning in a sand bed due to a 0.6 ratio in spatial frequency of the vertical and horizontal waves.

Movie S5



Movie S6. The snake robot (at 3× speed) navigating a trackway using the three turn types described in this paper.

Movie S6

Dataset S1. Paired *t* tests results between waveform and locomotion variables before and after reversals

Dataset S1

Dataset S2. Statistical tests of waveform and locomotion variables between individuals

Dataset S2

Repeated-measures ANOVAs use turn type as a fixed, crossed factor and individual as a random, crossed factor. Means are reported in the test notes unless they are given in the main text.

Dataset S3. Statistical test of robot vs. snake turn magnitude

Dataset S3

Turn type and robot versus biological are both fixed, crossed factors.

Dataset S4. Lengths, masses, and number of sequences of each type for each individual

Dataset S4

Dataset S5. Regression results for waveform and locomotion variables against turn angle within turn types

Dataset S5