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Modeling of a crawling C. elegans in a micro-structured environment[1] AMAR PATEL, VENKAT PADMANABHAN, DEEPAK SOLOMON, ZEINA KHAN, Texas Tech University, FRANK VAN BUSSEL, Max Planck Institute for Dynamics and Self-Organization, SIVA VANAPALLI, Texas Tech University, KENDRA RUMBAUGH, Texas Tech University Health Sciences Center, JERZY BLAWZDZIEWICZ, Texas Tech University — A simple curvature-based model is used to study crawling C. elegans in a micro-structured environment of periodic pillars. In our model system, the shape of the worm is described by a simple sinusoidal expression in curvature representation. The gait of the worm is determined by a set of parameters including the amplitude, frequency, and phase of the curvature. The moving worm is subject to the friction with the underlying substrate, and the forces due to interaction of the worm body with pillars. If the friction is isotropic the worm has to interact with the pillars to move forward. We find that only a narrow range of worm gaits leads to efficient propulsion in this case. To investigate how the worm adjusts its gait to the environment microstructure, we implement a simple control system that chooses the right set of parameters based on the past interactions of the worm with its surroundings. Results of our simulations of the worm motion are compared with our experimental observations of C. elegans crawling in an agar environment containing an array of fabricated pillars.

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