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Fast Computation of Fully Resolved Neuromechanically Simulated Locomotion[1] NAMU PATEL, Department of Engineering Sciences and Applied Mathematics, Northwestern University, NEELESH A. PATANKAR, Department of Mechanical Engineering, Northwestern University — In fish, caudally propagating waves of neural activity produce muscle bending moments. These moments, coupled with forces due to the body's elastic properties and forces due to fluid-body interactions, determine the deformation kinematics for swimming. Fully resolved simulations of neurally-activated swimming can be used to decode activation patterns underlying observed behaviors in a swimming animal. These computations are expensive; the time stepping requirement is onerous due to the canonically used explicit coupling between the elastic body and the fluid. To overcome this barrier, we use our prior result that deformation kinematics closely follow the preferred kinematics due to muscle activation when a swimmer has a sufficiently stiff body. Thus, we can impose the preferred deformation kinematics directly on the body immersed in the fluid. In this way, the need to solve the elastic equations is eliminated. Here, we couple physiochemical and physiomechanical equations to a constraint-based self-propulsion formulation. With this method, we demonstrate how different behaviors, such as turning, emerge from varying the neural signal.

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