Abstract Submitted
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Swimming of a Ciliated Microorganism HANLIANG GUO, EVA KANSO, University of Southern California — We propose a 2D model to consider the locomotion of a ciliated microorganism in a viscous fluid. The model consists of a circular body whose boundary is covered by a finite number of cilia. Stokes paradox does not hold due to the self-propelling nature of the organism. Using a regularized Stokeslet method, we determine numerically the time-dependent swimming motion for prescribed kinematics (undulatory beat) of the individual cilium. Phase differences between neighboring cilia result in metachronal waves characteristic of biological cilia. We compare our results based on the discrete cilia approach with the envelope model proposed by JR Blake. We then study the net locomotion as function of the metachronal wave. We find that, for a given geometry and cilia density, there is an optimal wave number (phase difference) for locomotion in terms of velocity of propulsion and efficiency.

Hanliang Guo
University of Southern California

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