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Optimality of Metachronal Paddling in Crustacean Swimming ROBERT GUY, Department of Mathematics, University of California Davis, CALVIN ZHANG, Courant Institute of Mathematical Sciences, New York University, TIMOTHY LEWIS, Department of Mathematics, University of California Davis — Crayfish and other long-tailed crustaceans swim by rhythmically moving four or five pairs of limbs. Despite variations in limb size and stroke frequency, movements of ipsilateral limbs always maintain a tail-to-head metachronal rhythm with an approximate quarter-period inter-limb phase difference. Relatively few studies have examined the fluid dynamics of metachronal limb stroke for the range of Reynolds numbers at which crustaceans operate. Here, we use a computational fluid dynamics model to explore the performance of different paddling rhythms. We show that the natural tail-to-head metachronal rhythm with an approximate quarter-period phase difference is the most effective and efficient rhythm across a wide range of Reynolds numbers.

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