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Metachronal versus hybrid stroke kinematics on multi-appendage swimming performance[1] MITCHELL FORD, TYLER BLACKSHARE, ARVIND SANTHANAKRISHNAN, Oklahoma State University — Aquatic invertebrates have developed distinct locomotion strategies suited to their morphology and swimming behaviors. Many of these invertebrates, particularly crustaceans, move by paddling multiple limbs in sequence. The gaits used by different species can vary, with a purely metachronal (phase-delayed) stroke (MM) commonly found in continuously swimming species such as krill, and a metachronal power stroke followed by a near-synchronous recovery stroke (MS) commonly seen during rapid maneuvering behaviors in benthic and planktonic species such as mantis shrimp and copepods. Using a robotic model, we examine the effect of changing between these two swimming gaits on swimming speed and wake structure. Regardless of phase delay, the main benefit to using MS as opposed to MM is that it allows for a larger stroke amplitude. This allows MS to achieve faster swimming, even though MS is slower than MM for the same stroke amplitude. Additionally, the wake jet generated by MS is more dispersed, while MM generates a narrow, downward angled jet which may be useful for hydrodynamic signaling in schooling groups.

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