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Development and validation of a bio-inspired, self-propelled metachronal swimming robot[1] ARVIND SANTHANAKRISHNAN, MITCHELL FORD, Oklahoma State University — Metachronal swimming is a method of drag-based locomotion used by crustaceans such as krill, mysids, and shrimp. Studies of metachronal swimming can help in understanding ecologically important daily vertical migrations of these organisms and their hydrodynamic signaling mechanisms. We developed a robotic model ("krillbot") and validated its performance using published data on Pacific and Antarctic krill. Dynamic scaling was used to design the krillbot body and test conditions. The krillbot was suspended in an 8-foot long tank filled with water-glycerin mixture, and was allowed to self-propel on an air bearing. Time-resolved PIV measurements during self-propulsion showed that interaction of shear layers of adjacent paddles resulted in the formation of a continuous jet moving in the caudoventral direction. Swimming speed and orientation of the jet varied with phase lag and paddling frequency. Displacement efficiency and Reynolds number based on swimming speed were found to fall within the range observed in freely swimming krill.

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