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Importance of appendage spacing in metachronal swimming[1]
MITCHELL FORD, ARVIND SANTHANAKRISHNAN, Oklahoma State University — Drag-based metachronal paddling of multiple appendages is a common swimming strategy used by numerous aquatic animals (such as copepods, krill, and comb jellies) across a wide range of Reynolds numbers. These organisms have been reported to have a narrow range of dimensionless appendage spacing (ratio of inter-appendage spacing to appendage length) between 1/5 and 2/3 (Murphy et al., Mar. Biol. 158, 2011). Small inter-appendage spacing could allow for synergistic interaction of shear layers formed by paddling of adjacent appendages, whereas large inter-appendage spacing could effectively isolate individual appendages from each other. Using a robotic metachronal swimming model ("krillbot"), we investigated the effects of varying appendage spacing on propulsive forces, swimming speed, and wake characteristics for appendage spacings both within and greater than the biological range. Swimming speed was found to increase both with closer spacing of paddling appendages and with increasing paddling frequency. PIV-based flow visualization results will be presented.

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