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Numerical analysis of the force generation mechanism in a stingray inspired circular plan-forms RAVI CHAITHANYA MYSA, PABLO VALDIVIA Y ALVARADO, Singapore University of Technology and Design — The effects of stingray inspired traveling wave kinematics on propulsive forces in a circular plan-form are studied in detail as part of this numerical study. Numerical flow experiments are performed at a Reynolds number of 500 on a circular plan-form for traveling waves of various amplitudes, frequencies and wave numbers. The thrust coefficient increases with increase in frequency and amplitude of wave motion. There exists a critical wave number at which the maximum thrust coefficient occurs. The magnitude of increase in thrust coefficient with increase in wave number before the critical point is greater than the magnitude of decrease in thrust coefficient with increase in wave number after the critical point. The pressure distribution on the circular plan-form is investigated in detail to understand the mechanism of force generation due to the interaction of the plan-form with the flow. At a given instant, the pressure distribution on one side of the plan-form is due to exchange of momentum between the flow and the plan-form. On the opposite side of the plan-form the pressure force is due to the edge vortex which creates suction pressure.

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