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Computational Analysis of Thrust Generation in a Foil with Travelling Wave on Its Surface[1] SARVESH SHUKLA, ATUL SHARMA, AMIT AGRAWAL, RAJNEESH BHARDWAJ, Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai 400076, India — We present an analysis of propulsive performance in a 2D foil with travelling wave on its surface using the in-house level-set based immersed boundary method solver. Four governing parameters: Reynolds number , velocity ratio ($V_R = c/U_\infty = [1 - 10]$), amplitude ($A_m = [0.1 - 0.5]$) and wavenumber ($k = [5 - 20]$) of the travelling wave, have been varied to study its effect on the total drag. The propulsive efficiency and thrust coefficient have been used as output data for propulsive performance analysis. In the travelling wave motion, the generation of thrust force is because of the high-pressure and high-velocity zone at the trough of the wave on the foil surface. This high-pressure and high-velocity zone produces the localized thrust jet, which ultimately makes the body to move forward. The time-averaged value of total drag has been found to become negative (i.e. net thrust) for $V_R \geq 1.2$ at $Re = 5000$ with $A_m = 0.3$ and $k = 10$ of travelling wave. The propulsive efficiency increases with increasing V_R and reaches to its maximum and starts to decrease after a further increase in V_R. The variation of the phase angle between the upper and lower surfaces of the foil has also been studied. At $\phi = 180^o$, $< C_T >$ is maximum while $C_{L_{rms}}$ is minimum.

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