Abstract Submitted
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Fluid forces and flow transitions for a NACA0012 hydrofoil at low Reynolds numbers[1] SIDDHARTH GUPTA, JISHENG ZHAO, MARK THOMPSON, Monash University, Australia, ATUL SHARMA, AMIT AGRAWAL, IIT Bombay, INDIA, KERRY HOURIGAN, Monash University, Australia — A study has been conducted to investigate the effect of angle of attack (α) on the hydrodynamic performance and wake structure of a static NACA0012 hydrofoil in a free-stream flow at low Reynolds number (Re). The investigation employed water-channel experiments and in-house numerical simulations (based on an immersed interface method) over the angle of attack range of $0^o \leq \alpha \leq 90^o$ and the Reynolds number range of $2000 \leq Re \leq 10,000$. The angle of attack of a foil is an important parameter affecting the fluid dynamics and fluid-structure interaction; however, this problem has been poorly understood at low Reynolds numbers and particularly at large angles of attack, despite its importance in numerous applications, such as fish-like locomotion, autonomous underwater vehicles, bird-insect flights, micro-air vehicles, and wind turbines. The present findings showed that there exist different flow regimes and transitions over the α and Re ranges investigated: e.g., a laminar flow regime is observed for $0^o \leq \alpha \leq 5^o$, followed by a transition regime prior to three distinctly different vortex shedding modes I, II and III for higher angles of attack. More details will be presented at the Division of Fluid Dynamics Meeting.

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