

Abstract Submitted
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Strouhal number for free swimming¹ MEHDI SAADAT, University of Virginia, TYLER VAN BUREN, DANIEL FLORYAN, Princeton University, ALEXANDER SMITS, Princeton University, Monash University, HOSSEIN HAJ-HARIRI, University of Virginia — In this work, we present experimental results to explore the implications of free swimming for Strouhal number (as an outcome) in the context of a simple model for a fish that consists of a 2D virtual body (source of drag) and a 2D pitching foil (source of thrust) representing cruising with thunniform locomotion. The results validate the findings of Saadat and Haj-Hariri (2012): for pitching foils thrust coefficient is a function of Strouhal number for all gaits having amplitude less than a certain critical value. Equivalently, given the balance of thrust and drag forces at cruise, Strouhal number is only a function of the shape, i.e. drag coefficient and area, and essentially a constant for high enough swimming speeds for which the mild dependence of drag coefficient on the speed vanishes. Furthermore, a dimensional analysis generalizes the findings. A scaling analysis shows that the variation of Strouhal number with cruising speed is functionally related to the variation of body drag coefficient with speed. *Ref:* Saadat, M. and Haj-Hariri, H. Role of Strouhal number (St) in free swimming. American Physical Society, 65th Annual DFD Meeting, San Diego, CA, Nov 1820, 2012.

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