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Amplitude Effects on Thrust Production for Undulatory Swimmers BRITTANY GATER, JAVID BAYANDOR, Virginia Tech — Biological systems offer novel and efficient solutions to many engineering applications, including marine propulsion. It is of interest to determine how fish interact with the water around them, and how best to utilize the potential their methods offer. A stingray-like fin was chosen for analysis due to the maneuverability and versatility of stingrays. The stingray fin was modeled in 2D as a sinusoidal wave with an amplitude increasing from zero at the leading edge to a maximum at the trailing edge. Using this model, a parametric study was performed to examine the effects of the fin on surrounding water in CFD simulations. The results were analyzed both qualitatively, in terms of the pressure contours on the fin and vorticity in the trailing wake, and quantitatively, in terms of the resultant forces on the fin. The amplitude was found to have no effect on the average thrust during steady swimming, when the wave speed on the fin was approximately equal to the swimming speed. However, amplitude was shown to have a significant effect on thrust production when the fin was accelerating. This finding suggests that for undulatory swimmers, amplitude is less useful for controlling swimming speed, but can be used to great effect for augmenting thrust during acceleration.

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