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Scaling Laws for the Propulsive Performance of Self-Propelled Three-Dimensional Pitching Panels[1] FATMA AYANCIK, KEITH MOORED, Lehigh University — Inviscid computational results are presented within a boundary element numerical framework on a self-propelled virtual body combined with a rigid three-dimensional rectangular plate undergoing pitching motions about its leading edge. New scaling laws have been developed for the thrust and power as well as self-propelled speed, efficiency, and cost of transport by incorporating three-dimensional effects for varying aspect ratios. A lifting line theory correction is applied to account for the variation of the circulatory forces due to three-dimensional effects and the alteration of the added mass forces with aspect ratio changes is also considered. The scaling laws show that when accounting for three-dimensional effects, the physics of mean thrust production follows linear theory well, while the power must be modified with nonlinear corrections.

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