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The three-dimensional wake of a swimming cylinder MEHDI NAZARINIA, DAVID LO JACONO, JOSIE CAEBERRY, MARK C THOMPSON, JOHN SHERIDAN, Monash University, FLUIDS LABORATORY FOR AERONAUTICAL AND INDUSTRIAL RESEARCH (FLAIR) TEAM — Previous two–dimensional numerical studies have shown that a circular cylinder undergoing both oscillatory rotational and translational motion can generate thrust so that it actually self–propels through a stationary fluid. The current research reported here extends that study both experimentally and numerically, recording detailed vorticity fields in the wake and using these to elucidate the underlying physics, examining the development wake three–dimensionality experimentally, and determining the stability of the wake to the growth of three–dimensional flow through Floquet stability analysis. In particular, we find that the wake undergoes three–dimensional transition at low Reynolds numbers to a instability mode with a wavelength of about two cylinder diameters. The stability analysis indicates that the base flow is also unstable to another mode at slightly higher Reynolds numbers, broadly analogous to the three-dimensional wake transition for a circular cylinder despite the distinct differences in wake/mode topology. The three-dimensional transition leads to significant changes to the mean two-dimensional base flow, and the effect on the forces on the cylinder are currently under investigation.

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