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The Influence of Reynolds Number on the Dynamics of Wing-Tip Vortices[1] TOM SMITH, YIANNIS VENTIKOS, University College London — Tip vortex flows are of considerable interest across a range of technologies and can be significant noise sources, particularly in hydrodynamic applications where tip-vortex cavitation can occur. There are still many open questions regarding the dynamics of this type of flow including Reynolds scale effects and the dynamics of wake-like and jet-like vortex cores. In this study, we use Direct Numerical and Large Eddy Simulations to study the flow over a finite-span elliptical foil at low and moderate Reynolds numbers. Grid convergence is achieved to improve confidence in the validity of the simulations and to develop a better understanding of the mesh requirements for this type of flow. A detailed analysis of the roll-up process is carried out, highlighting significant differences in the flow as the Reynolds number increases. At low Reynolds numbers, a single laminar vortex forms with a very low axial velocity in the core. Higher Reynolds numbers see the emergence of multiple vortices which merge in the near wake. The magnitude and longitudinal position of the minimum pressure is also found to depend on the Reynolds number, which has important consequences for cavitation predictions and scaling.

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Tom Smith
University College London

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