

## **Airfoil starting and stopping vortices (1, 2, or 3 students)**

<https://www.youtube.com/watch?v=VcggiVSf5F8>

Nearly a century ago, Prandtl's experiments in support of the circulation theory of lift (see video) demonstrated the generation of starting and stopping vortices for a lifting airfoil suddenly set in motion, then brought to rest. Recently, two-dimensional numerical simulations of the flow have supported the main findings but also produced some surprising results, such as production of leading edge vortices during the stopping phase.

The project has a number of separate but related parts, all computational:

- a. Examination of the details of 2D vorticity generation around the airfoil during starting and stopping phases;
- b. 3D simulations and snapshot-based analysis of instabilities of the basic 2D flow;
- c. Transient stability analysis of 3D structures that evolve on top of the 2D basic flow.