Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Wake instabilities of flow over a spinning circular disk at angle of attack[1] MARCUS LEE, TIM COLONIUS, BEVERLEY MCKEON, Caltech — A circular disk spinning about its axis of rotational symmetry is inherently robust to external disturbances due to gyroscopic moments and is therefore a promising configuration for a robust micro air vehicle. However, literature on the wake structures and flow behavior associated with spinning disk aerodynamics remains limited, particularly at angles of attack relevant to flight. We thus use a three-dimensional immersed boundary method for incompressible viscous flows to study the effects of angle of attack, Reynolds number, and tip-speed ratio on spinning disk aerodynamics. We observe a Hopf bifurcation corresponding to a bluff-body wake instability at a critical Reynolds number and/or angle of attack, above which periodic vortex shedding occurs. We then examine how increasing the tip-speed ratio affects the stability and structure of the flow.

[1]Supported by Boeing

Marcus Lee
Caltech

Date submitted: 31 Jul 2017 Electronic form version 1.4