Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Control of Unstable Slender Axisymmetric Bodies at High Incidence.[1] EDWARD LEE, YOU HUANG, BOJAN VUKASINOVIC, ARI GLEZER, Georgia Inst of Tech — The unsteady flow over and aerodynamic loads on a wire-mounted slender axisymmetric body ($L/D = 9$) fitted with an upstream forebody ($l/D = 2$) are investigated at high angles of incidence (up to 65) in wind tunnel experiments. At high incidence, the vortex pair which forms over the forebody interacts with the hierarchy of vortical structures that form as a result of streamwise-successive separation off the cylinder. Time-varying asymmetries of these vortex-wake interactions about the model's vertical center plane result in unbalanced side forces and yawing moment that are coupled to motion of the wire-mounted model. Although the model is nominally stable to such time-varying loads, under certain conditions it can become unstable to angular oscillations. The present investigations utilize the receptivity of the forebody flow to small perturbations for controlling the evolution of the forebody vortices and thereby their aerodynamically-unstable coupling to the cylinder's wake. Upwind actuation is effected by surface synthetic jet actuators mounted at the juncture between the forebody and the cylinder. It is shown that the flow is extremely receptive to actuation at high incidence and the model's angular stability can be restored.

[1]Supported by ARO

Edward Lee
Georgia Inst of Tech

Date submitted: 10 Aug 2020 Electronic form version 1.4