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Time-dependent measurements over membrane plates at low Reynolds number[1] JAMES HUBNER, KYLE SCOTT, University of Alabama, AMORY TIMPE, LAWRENCE UKEILEY, University of Florida — A segment of low Reynolds number aerodynamic research employs biomimetics for optimization of airfoil shapes to micro air vehicle (MAV) flight. Many of these efforts focus on thin, flexible membrane airfoils inspired by small birds, bats and insects. This design approach, mimicking low Reynolds number flyers ($Re < 100{,}000$), has led to improved aerodynamic performance, particularly the mitigation of flow disturbances through passive aerodynamic and geometric twisting. In many cases, membrane vibration exists, altering the characteristics of the separated shear layer over the wing, leading to both advantageous and disadvantageous effects. Identifying and quantifying the nature of the fluid-structure coupling and how this coupling can passively control the flow is the goal of a recently initiated research project by the authors. This talk will present the objectives of the project and initial findings of synchronized flow (hot-wire anemometry) and surface deflection (laser vibrometry) measurements over rigid plates and flexible membranes at incidence to the free stream flow. A range of flow Reynolds numbers are examined, from 10,000 to 50,000, in which vibration initiates and grow with increasing velocity.

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James Hubner
University of Alabama

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