DISTRIBUTED CONFORMAL ACTUATION WITH ELECTRO ACTIVE POLYMERS

Sponsor: Infoscitex  
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PROJECT DESCRIPTION

The application of electro-active polymer (EAP) at critical aerodynamic surfaces of Micro Air Vehicles (MAVs) is used to manage the boundary layer at these locations. EAP offers a means to achieve distributed actuation and can be readily conformed to the shape of an airfoil. At low Reynolds number-flight, typical of MAVs, the intent is (1) to promote transition to turbulence, where laminar separation would otherwise occur, and (2) to maintain laminar flow, where separation is not an issue. In Phase I, requirements for frequency, amplitude, and spatial character of the desired shape perturbations to the nominal airfoil shape will be established, including dynamic roughness (high spatial and temporal frequencies) and camber control (low spatial and temporal frequencies). From these requirements, EAP layers is manufactured and applied to a boundary layer over a flat plate (Figure 1). The bench tests will verify the capability of the EAP design to meet the established requirements in a lab environment, and indicate suitable improvements to the design. Tests are conducted in a specially designed small-scale wind tunnel (Figure 2) in order to demonstrate the ability of the EAP surface to affect flow in a controlled manner. In Phase II, EAP will be applied to airfoils with compound curvature and with large and time-varying pressure gradients, and the benefits would be measured in a wind tunnel.
Figure 1. Flat plate model with EAPs.

Figure 2. Low Reynolds number wind tunnel facility.