Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Effect of Actuation Parameters on Opposition Control of Transient Growth in a Blasius Boundary Layer Using Plasma Actuators
RONALD HANSON, PHILIPPE LAVOIE, University of Toronto, Aerospace Studies, AHMED NAGUIB, Michigan State University, Mechanical Engineering — This work is concerned with investigating an actuation scheme, using plasma actuators, designed to negate the effect of the transient growth instability occurring in a Blasius boundary layer and, by this means, delaying the bypass transition process. The actuators investigated consists of a spanwise array of symmetric plasma actuators, which are capable of generating spanwise periodic counter-rotating vortices. The effectiveness of the actuator array was tested on disturbances introduced via an array of cylindrical roughness elements. Early investigations have demonstrated a reduction of the total disturbance energy produced by the roughness elements by up to 68% depending on the actuator geometry. In the present study, the focus is on determining the effect that the excitation signal supplied to the actuator, such as waveform, frequency and amplitude, can have on the receptivity of the boundary layer to the plasma forcing. It is found that the excitation can change the modal content of the disturbance introduced inside the boundary layer by the actuator. The consequences of these results are discussed with respect to actuator modelling and issues related to eventual integration with a feedback control system for transition control.

Ronald Hanson
University of Toronto, Aerospace Studies

Date submitted: 06 Aug 2009 Electronic form version 1.4