

Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Flow Control Using Zero-Mass Flux (ZMF) with Superposition of Steady Suction. B. DEMANETT, T. REYNOLDS, J. KIEDAISCH, H. NAGIB, IIT, USA — Most studies of Active Flow Control (AFC) applied to separated flows have centered upon blowing. More recently, focus has been on oscillatory blowing and Zero-Mass Flux (ZMF). However, ZMF with superposition of steady suction, or oscillatory suction, has been largely neglected. This investigation was initiated in an effort to reopen avenues of using more efficient suction for flow control, particularly through use of unsteady means other than ZMF. Oscillatory suction was made possible because of improvements made in the ZMF actuators designed at IIT. The stability of the new design allowed steady suction to be used in conjunction with the ZMF actuators in a generic separated flow field over a hump model. The study demonstrated that ZMF and steady suction, both alone and in combination, have a dramatic effect in altering pressure distributions over the aerodynamic surface. Steady suction was found to have a marginal advantage over the combination, and it provided a slightly lower minimum pressure before saturation of the flow occurred. The oscillatory suction control, with smaller input amplitudes, was able to perform nearly as well as steady suction and better than ZMF alone. Contrary to general belief, the results of this study indicate that for separated flows similar to the one examined here, ZMF may not be the most effective, and traditional parameters used to characterize the AFC performance, such as blowing momentum coefficient, are not the proper choice.

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Date submitted: 12 Aug 2005

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