AEROSPACE & MECHANICAL ENGINEERING

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UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

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SPEAKER: **Professor Datta V. Gaitonde**
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The Ohio State University
Columbus, Ohio

TOPIC: **LARGE-EDDY SIMULATIONS TO UNDERSTAND FLOW CONTROL WITH SMALL PERTURBATIONS**

DATE: Tuesday, September 18, 2012

TIME: 3:30 p.m.

PLACE: Lower Level Auditorium, Geddes Hall

RECEPTION: 3:00 – 3:30 p.m. – Coffee House, Geddes Hall

ABSTRACT

High-fidelity simulations will become ever more important in the future if their use is routinely extended beyond engineering prediction to scientific analysis of the underlying physics. In this talk, we highlight such use of CFD to understand plasma-based flow control techniques, with emphasis on how relatively small disturbances couple to the flowfield. Recent experimental results have shown substantial promise for different objectives, including separation mitigation, shock modification and noise modulation. The observations clearly show that the mechanisms at play depend on the specifics of the actuator. We describe results of Large-Eddy Simulations on wall bounded (flat plate boundary layers), free shear (jets) and fully separated (stalled airfoils) situations to elucidate these mechanisms. A degree of empiricism must be invoked in modeling the actuator, since a first-principles approach that simultaneously resolves all pertinent plasma mechanisms and fluid scales is not presently feasible. Two distinct unsteady mechanisms, based either on force or heating, emerge as candidates for control authority. Dielectric barrier discharges (DBDs), comprised of a flush mounted and embedded electrode combination, enforce either type of mechanism depending on the electrical excitation profile while Localized Arc Filament Plasma Actuators (LAFPA) can be successfully represented with heating alone. In all cases, the actuator induces coherent structures whose interaction with the main flow depends on features of the flow as well as the frequency of the excitation.

NOTE: ***If you are interested in meeting individually with Prof. Gaitonde, please contact Linda at 631-5431***