Center for Environmental & Applied Fluid Mechanics

"Adjoint-based Optimization of Turbulent Mixing-layer Evolution"

Presented by
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Upstream flow conditions have a large impact on mixing layers. Optimizing these conditions can significantly improve mixing effectiveness, which may have potentially a large impact in many areas of technology. The current presentation focuses on a simplified model for mixing layers, i.e., a temporal mixing layer, where the role of upstream conditions is replaced by the initial condition of the temporal layer. Direct numerical simulations are combined with a gradient-based optimization algorithm and used to optimize the spatial distribution of small perturbations imposed on a mean background initial profile. In order to efficiently calculate the gradient of the optimization cost functional, a set of adjoint partial differential equations is solved. During the presentation, the adjoint methodology will be introduced in a continuous framework, and advantages and drawbacks of this method are discussed. The talk further concentrates on algorithms to impose the necessary energy and continuity constrains on the initial perturbations. Finally, results of mixing-layer optimization are presented: in particular the effect of the optimization time window and the effect of selected cost functionals on the optima are discussed.

Friday, March 27, 2009
11:00 a.m., 110 Maryland Hall