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GRADUATE SEMINAR

Validation and Implementation of Advanced Turbulence Models in Swirling and Separated Flows

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***Date*:** May 2, 2003
***Time*:** 3:00 - 4:00 p.m.
***Place*:** 755 Baldwin Hall

Refreshments: 2:45 – 3:00 p.m.

ABSTRACT

The objectives of this study are to compare the performance of six turbulence models for a variety of turbulent flows and also to examine the models' sensitivity to grid resolution and freestream turbulence. These models include the linear V2F model of Durbin, two nonlinear quadratic models of Rumsey and Gatski: one with $k-\varepsilon$(EASM $k-\varepsilon$) and the other with $k-\omega$(EASM $k-\omega$); the nonlinear cubic model of Craft et al. and two nonlinear cubic models of Shih et al.. The flows that are investigated are (1) three free-shear flows including a mixing layer, a plane jet, and a round jet; (2) flat plate boundary layer; (3) flow over an axisymmetric cylinder with strong pressure gradients; and (4) axially rotating pipe. It is shown that none of the models performed well for all test cases. The Shih II model shows a better result than the others in free-shear flows and in the rotating pipe, but fails to predict flow separation with strong pressure gradients. The EASM $k-\omega$ is found to be capable of capturing the flow separation caused by the strong pressure gradients. Although the model is not sensitive to freestream turbulence in free-shear flows, it is found that the model is still sensitive the freestream turbulence in a flat plate boundary layer and in the flow over cylinder with strong pressure gradients.

BIOGRAPHICAL SKETCH

Dr. George Huang is an associate Professor and Director of Graduate Studies of Mechanical Engineering Department, University of Kentucky. Prior to his arrival at the University of Kentucky in 1996, Dr. Huang was a Senior Research Scientist at MCAT/ELORET/NASA-Ames where he was a co-author of the award-winning OVERSET Tools for CFD analysis. His current research interests include laminar-turbulent transition, advanced turbulent models and computational schemes, multi-processor CFD, and technology transfer between academia, government laboratories, and industry. The website of the CFD group led by Dr. Huang is http://www.engr.uky.edu/~cfd.

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