

DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

FALL 2008 SEMINAR SERIES

Date: Thursday, October 16, 2008

Time: 11:00 am – 12:00 pm

Room: SL 165

Everyone is invited

**“Synthetic-Velocity” Subgrid-Scale Models for Large-Eddy Simulation
of Interactions of Turbulence with Other Physics**

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Abstract.

We begin with a brief review of the range of computational tools available for turbulent flow calculations at the beginning of the 21st Century and point out that large-eddy simulation (LES) is rapidly becoming the dominant simulation technique for engineering applications due to ever increasing computer capability. We then focus attention on the classes of subgrid-scale (SGS) models currently employed with this method, and we note that most are unable to predict fluid behavior at scales often encountered in interactions of turbulence with other physical phenomena, e.g., combustion and various biological flows. We argue that use of synthetic-velocity (and scalar, when appropriate) SGS models has the potential to improve such predictions, and we proceed to demonstrate construction of a particular example of such methods based on the “poor man's Navier–Stokes equation” discrete dynamical system. We conclude by presenting some a priori results obtained from this model, particularly, comparing these with theories of Kolmogorov; and we provide preliminary results from a complete synthetic-velocity/scalar LES procedure.

About the Speaker.

Dr. McDonough is a Professor of Mechanical Engineering, and of Mathematics, at the University of Kentucky, Lexington. He received his BS in Aero-Astro Engineering from the Ohio State University in 1968 and immediately began his career at the McDonnell Douglas Astronautics Co., Culver City and Santa Monica, CA, where he worked in medium launch vehicle propulsion and anti-ballistic missile guidance and control. He received a MA in Applied Mathematics from UCLA in 1975 and worked as a numerical analyst for the software firm, Prose, Inc., Los Angeles. Dr. McDonough completed his PhD in Engineering at UCLA in 1980 and joined the Aerospace Corp., El Segundo, CA, where he worked in computational fluid dynamics (CFD). He was a Visiting Lecturer, and then Adjunct Assistant Professor, at UCLA until accepting an Associate Professorship at the University of Kentucky in 1990. Dr. McDonough has held his current position(s) since 1999 and conducts research and teaches classes in applied numerical analysis, CFD and fluid dynamics; he is Director of the Graduate Curriculum in CFD. His biography appears in numerous Who's Who volumes, including Who's Who in America (2008 and 2009 editions), and he was recently a Visiting Professor of Power Mechanical Engineering at the National Tsing Hua University, Hsinchu, Taiwan.