CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
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SEMINAR SERIES

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The Effects of Perturbations on Flow Model Stenotic Arteries

Flow in the human body is designed to be laminar and regular. A few exceptions where turbulence plays a role are speech production and pathological flow in the circulatory system. Speech production involves unsteady pulsatile flow and turbulent structures that affect the aeroacoustics. Examples of pathological blood flow in which unsteadiness, separation and turbulence are important include regurgitant heart valves, stenoses or blockages, and branches and bifurcations. Pulsatile unsteady phenomena, coherent vortical structures and transitional flow or turbulence occurring at low Reynolds numbers are common to these biological flows. An overarching motivation for studying hemodynamics and speech production is to facilitate surgical planning, i.e. to enable physicians to assess the outcomes of surgical procedures by using faithful computer simulations. Such simulations are on the horizon with the advent of increasingly more powerful high performance computing and cyberinfrastructure, but they still lack all the appropriate models. This seminar will emphasize our cardiovascular-flow-related research program, where the goal is to investigate the fluid dynamics stimuli of pathological flows on the endothelial cells lining the intima of the arteries. The motivation is to understand the cycle of plaque formation that occurs in the disease atherosclerosis. A multidisciplinary effort with colleagues in Biomedical Engineering enables study of the fluid dynamics in the presence of live cells. Because actual cells are subjected to the flow and then analyzed for biochemical and genetic response, the facility cannot be scaled-up. Thus, techniques such as micro-PIV and MEMS-based wall shear stress sensors are required to characterize the flow. Another important objective is to enable computations with realistic inlet and boundary conditions. Our work on perturbations addresses the sensitivity of pulsatile flow in arteries to changes in inlet conditions such as curvature and velocity profile distortion.

Biographical Sketch

Dr. Michael W. Plesniak is the *Eugene Kleiner Professor for Innovation in Mechanical Engineering* at Polytechnic University in Brooklyn, NY and an Adjunct Professor of Mechanical Engineering at Purdue University. He recently completed a term as the Director of the Fluid Dynamics & Hydraulics program at the National Science Foundation. Prof. Plesniak earned his Ph.D. degree from Stanford University, and his M.S. and B.S degrees from the Illinois Institute of Technology; all in Mechanical Engineering. Dr. Plesniak was elected a *Fellow of ASME* in 2006. His current research interests include: bio fluid mechanics, turbulence transport and mixing enhancement, cavitation, three-dimensional boundary layers, gas turbine cooling, environmentally-benign consumer aerosol sprays, and entrainment control. Dr. Plesniak has authored one hundred refereed archival publications and conference papers, over fifty non-refereed publications and presentations, and has presented numerous invited seminars and keynote addresses. He has served as an Associate Editor for the ASME *Journal of Fluids Engineering*.

TUESDAY – May 1, 2007 – Barus & Holley, Room 190 - 3:00pm