DEPARTMENT OF RADIOLOGICAL SERVICES
UNIVERSITY of CALIFORNIA, IRVINE • SCHOOL OF MEDICINE

RESEARCH SEMINAR SERIES IN RADIOLOGICAL SCIENCES

WHEN: Wednesday March 11, 2015

12:00 noon

WHERE: LIVE - Irvine Campus: Medical Education Bldg, Colloquium 3070

TELECAST - UC Irvine Medical Center: Radiology Conference Room 0117

NOTE: Guest Speaker, will be in Med Ed Colloquium 3070; video cast will be in UCIMC Radiology Conference Room 0117

Speaker: Said Elghobashi, Ph.D.

Professor at UCI in Mechanical and Aerospace Engineering

Title: "On locating the obstruction in the human upper airway via numerical simulation "

Abstract:

The fluid dynamic properties of the air flow in the human upper airway (UA) are not fully understood due to the three-dimensional, patient-specific complex geometry of the airway, the flow transition from laminar to turbulent, the mean flow reversal every two seconds during the breathing cycle, and the flow-structure interaction. This lack of understanding is because it is almost impossible to measure experimentally

the instantaneous velocity components at specific points in the human airway. However, the method of direct numerical simulation (DNS) *can predict* all the instantaneous flow properties and resolve all the flow length- and time-scales. The DNS solver that we developed is based on the lattice Boltzmann method (LBM), and we use it to investigate the flow in two patient-specific UAs reconstructed from CT scan data. Inspiration and expiration flows through these two airways are studied and compared. Instantaneous pressure gradient signals at different locations in the UAs are investigated and used to determine the location of the obstruction. The time-averaged gradient, $\frac{\partial p}{\partial z}$, is used to locate the region of the UA obstruction, while the time-averaged second spatial derivative of pressure, $\frac{\partial^2 p}{\partial z^2}$, is used to pinpoint the exact location of the obstruction.
The present results show that the DNS-LMB solver can be used to obtain accurate flow details in the UA and is a powerful tool to locate the obstruction.

About the Presenter

Dr. Said Elghobashi received his Masters in Mechanical Engineering from University of Southern California in 1971, and went on to get his Ph.D. in Mechanical Engineering from Imperial College, University of London in 1974. After obtaining his Ph.D., Dr. Elghobashi worked several years in industry before joining UC Irvine's Mechanical and Aerospace Engineering department in 1978. He has also earned a Doctor of Science degree from Imperial College in Mechanical Engineering in 1999. His primary research interest is the fundamental property of turbulence using the method of direct numerical simulation (DNS). His research is aimed at understanding some of the fundamental properties of turbulence using the direct numerical simulation (DNS) method, a numerical representation of the exact, three-dimensional, time-dependent Navier-Stokes equations. While the larger, long-term goal of his work is to predict engineering flows in complex geometries (the flow over an airplane or the flow of air inside a combustor, for example), Dr. Elghobashi currently is looking at chemically-reacting and particle-laden turbulent flows in simple geometries. Dr. Elghobashi's work can be used to improve the mathematical closure models employed in predicting turbulent flows in practical applications.