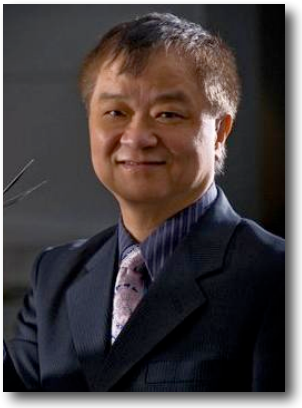
Mechanical Engineering Department Seminar

3:30pm March 7, 2011
1130 Mechanical Engineering



From Insects to Micro Air Vehicles – The Next Grand Challenge in Aerodynamic Design

George Huang

Professor and Chair, Mechanical and Materials Engineering, Wright State University; Director of Ohio Center of Excellence for Micro Air Vehicle Studies (CMAVS)

The mission of the Center for Micro Air Vehicle Studies is the advancement of technologies and methodologies for development of small UAVs and MAVs in support of both DoD and civilian missions and needs. For various military applications, the Air Force has set forth a goal of deploying a bird-sized MAV by 2015 and insect-size versions by 2030. The MAV potentially has a variety of civilian as well as military uses too difficult or dangerous for humans, from searching buildings or caves for terrorists to probing damaged nuclear power plants for radiation leaks or collapsed mine shafts for survivors.

There are at least eight inter-connected scientific disciplines within the MAV design trade space: airframe & structures, aerodynamics, navigation, feedback & control, materials, sensors & actuators, propulsion & power, and communications. Our aim is to push the envelope of the current commercial, off the shelf (COTS) technology in the early design cycle of MAV studies, including insect flight dynamics exploration, bio-mimicking rapid prototyping, high definition precision manufacturing and machining, computer optimization and simulation, wind-house experimentation and flight testing. The approach makes use of conventional precision machining methods, such as Rapid Prototyping 3D printing and sintering, Electrical Discharge Machining and Laser Micromachining techniques, to manufacture the MAV parts.

Our understanding of the fundamental flight aerodynamics for MAV is limited. Traditional fixed wing flight concepts begin to fail as the flow dynamics enter a regime of bird-sized flights. The small scale of such vehicles poses a need for a dramatic change in the air vehicle design paradigm, one as great as that faced by the Wright Brothers, in which they identified that control was the missing link in a workable aircraft. This new paradigm is simultaneous multi-disciplinary design of integrated multi-functional components and systems.

Bio George Huang did his undergraduate degree in Taiwan, MS in Canada (McGill University) and PhD at Manchester, England (UMIST). After finishing his PhD, Prof. Huang joined Michigan Technology University as an Assistant Professor in the Department of Mechanical Engineering. He moved to California to join Stanford University and NASA-Ames to pursue his interests in high-speed flow research related to the National Aero Space Plane. After seven years at NASA, Prof. Huang joined the Department of Mechanical Engineering at the University of Kentucky as Associate Professor and was subsequently promoted to full Professor. He was also the Director of Graduate Studies of the Department of Mechanical Engineering at the University of Kentucky. Prof. Huang is a recipient of the 2006 Silver Award and the Ackroyd Stuart Prize from the Royal Aeronautical Society, SC2000 Honorable Mention for the Gordon Bell Award in category “Price/Performance,” and Co-Winner, Honorable Mention, NASA Software of the Year (OVERFLOW), 1998. Prof. Huang is a Professional Engineer in Mechanical Engineering.