MMAE SEMINAR

WEDNESDAY, FEBRUARY 2, 2004
E-1 BUILDING – CRAWFORD AUDITORIUM
3:30 – 4:30 PM

Alternative Flight Mechanics for Miniature Aerial Vehicles

Avraham "Avi" Seifert
School of Mech. Eng., Faculty of Engineering, Tel-Aviv University, ISRAEL
e-mail: Seifert@eng.tau.ac.il

Abstract

Modern airplanes are large and safe, are economical, comfortable, and computer controlled. However, the aerodynamic functionality is disappointingly similar to that of the Wright Flyer. The three major flight systems are still separated: the wings provide the lift, the empennage and control surfaces provide attitude and guidance while the power plant provides the thrust. It is highly desirable to combine these into a single multifunctional system that will be real-time configurable. Using active flow control, a thick flying wing without any moving parts (e.g. propellers or control surfaces) could still perform all the required functions by using distributed power for flow control, thrust generation and attitude control, especially at low Reynolds numbers (<100,000).

In attempting to achieve these goals, significant obstacles arise. For example: a wing that should perform all the above functions and still have a vanishing pitching-moment is more difficult to control. The propulsors have to ingest non-uniform boundary layer flow that possesses lower momentum. The thicker wings, desirable from structural and functionality points of view are prone to boundary layer separation. Closed-loop control laws should be developed and sensing locations, physical properties and numbers should all be considered. Active flow control can be used to overcome the problems arising from the integration of aerodynamics, propulsion and vehicle control, making the system simpler, lighter, cheaper and effective.

The talk would provide a brief overview on active flow control and describe studies aimed at enabling the above tasks on a Miniature Aerial Vehicle (MAV).