Curriculum Vitae

Name: Dr. Raja Samikannu

Educational Qualifications:

Ph.D (Aerospace Eng., 2003, Indian Institute of Technology, Kharagpur)

M.Tech (Aerospace Eng., 1989, Indian Institute of Technology, Bombay)

Professional experience:

» Scientist EII, Project Leader,

» Aeroelasticity and Smart Structures (SDG), Structural Technologies Division, National Aerospace Laboratories (NAL), Bangalore

» Nearly 18 years in Research and Development Activities.

Research Interests:

» Structural Dynamics

» Aeroelasticity

» FEM

» Smart Structures

Awards / Honors received:

» DAAD Fellow, June 1997 to March 1999, DLR-Institute of Structural Mechanics, Braunschweig, Germany.

» Research Associate Awarded by Director General (CSIR), 2000-2002, C-MMACS (CSIR), Bangalore.

» Award for outstanding performance in design, development and project execution for "Detailed Experimental and Analytical Studies Leading to the Successful Aeroeleastic Testing of LCA Wing and GSLV Models", 1997.

» Smart Structure Technology award for developing, "Active Flutter Control Technique & Demonstration through Wind Tunnel Testing", Indian Society for Advanced Materials and Processing in Engineering (ISAMPE), 2005.

» JSPS Post Doctoral Fellow, Department of Aerospace Engineering, Nagoya University, Nagoya, Japan, 2006-07.

MAV Structures and Smart Materials Applications

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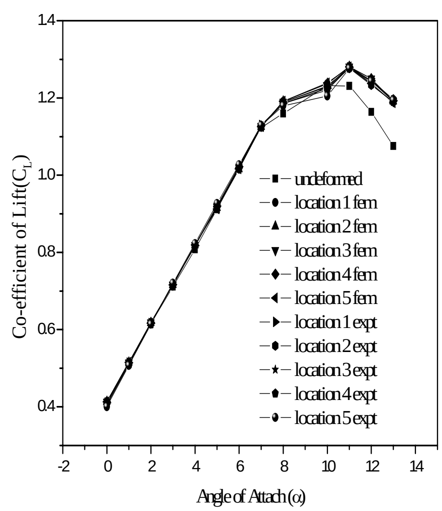
Micro air vehicles are tiny flying objects, which have potential applications in multiple fields. Though Propulsion and Control related issues are the critical areas for MAV, structural configuration poses equally a challenging task for the development of strategic MAV's. As weight becomes stringent design parameter, highly flexible but very light weight materials are used in some of the flying MAV's. However, we have made an attempt to use composite materials, along with low density materials like balsa to build NAL-MAV, named Black Kite. Even though, stresses, or frequencies coupling with aerodynamics are not being considered seriously, aeroelastic stability such as gust needs attention naturally, while attitude of MAV is addressed. Therefore, proper structural analysis is essential, in order to optimize the weight by retaining the aerodynamic configuration.

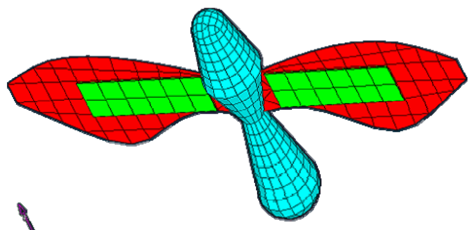
Smart structures technologies using smart materials are not mostly looked into for MAV applications. However, few studies have employed PZT, EAP and SMA materials. Using Eppler 387 airfoil, we have built an adaptive wing for MAV (Figure 1) to demonstrate the use of a piezoelectrically vibrating surface in flow control application. Further, a flapping wing concept (Figure 2) using two stripe actuators is developed and analyzed. Attempts are being made to use MFC/PZT tapes to develop active control surfaces for MAV- Black Kite (Figure 3).

Experimental setup of adaptive wing testing

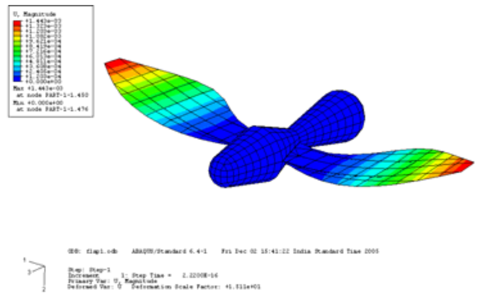


C_L Vs α (on average deformed shape: FEM and Expt.)

Figure1: Adaptive wing of MAV for flow control application

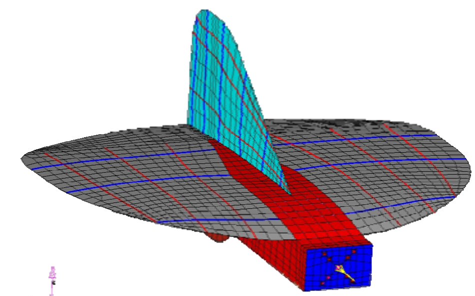


Finite element *model*

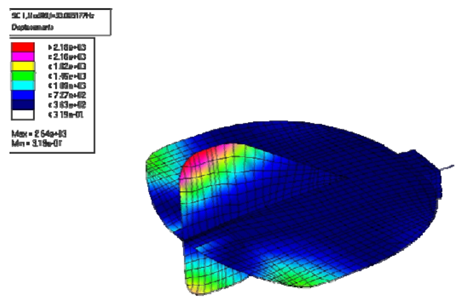


Displacement contour through piezoelectric actuation

Figure 2: Flapping wing MAV using stripe actuators



Finite Element *Model*



First Elastic Mode of Black Kite MAV @ 33.0851Hz

Figure 3: Structural Design and Analysis of Black Kite MAV

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1. Stanford, B., Viieru, D., Albertani, R., Shyy, W. and Ifju, P. (2006), *A Numerical and Experimental Investigation of Flexible Micro Air Vehicle Wing Deformation*,AIAA-2006-440 , 44th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 9-12, 2006.

2. Sathyamoorthy, S., Raja, S. and Stanley, A.J. (2006), *Piezoelectric Based Adaptive Wing for Flow Control*, J. of Aerospace Sciences and Technologies.

3. Imran Shaik (2005), *Design and Implementation of Flapping Wing Actuators for a Micro-Air-Vehicle*, BE Thesis (BITS, PILANI), Structural Technologies Division, NAL, December 2005.

4. Stanford, B., Ifju, P., Albertani, R. and Shyy, W. (2008), *Fixed membrane wings for micro air vehicles: Experimental characterization, numerical modeling, and tailoring*, Progress in Aerospace Sciences, 44(4), pp. 258-294.

5. Sytsma, M., Albertani, R., Viieru, D., Shyy, W., Ifju, P. and Stanford B., (2007), *Static Aeroelastic Model Validation of Membrane Micro Air Vehicle Wings*, AIAA Journal, 45(12), pp. 2828-2837.