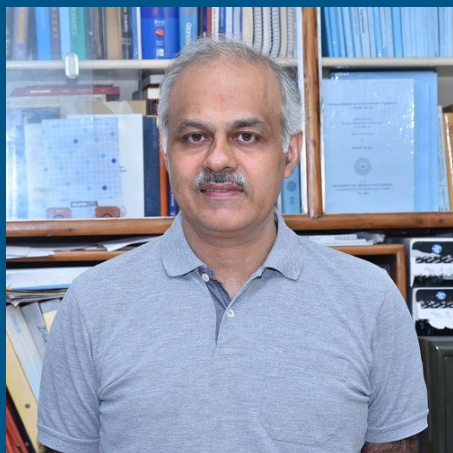


Friday, October 27, 2023, 10:30 – 11:30 am
Conference Room 47-124, Building E4



Flows past wings, sports projectiles and Fluid-Structure Interactions

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ABSTRACT: A summary of our recent research is presented. The flow past an end-to-end wing becomes unsteady beyond $Re=600$ approximately via the primary instability of the wake leading to vortex shedding. Three-dimensionality sets in at $Re\sim 1280.9$ via mode C instability and hairpin vortices. Interaction of the shear layer vortices with the separated boundary layer leads to formation of a Laminar Separation Bubble (LSB) at $Re\sim 20,000$, causing a delay in flow separation. Simulations for flow past a finite rectangular wing with NACA 0012 section at $Re=1000$ for various semi-aspect ratios ($0.25\leq sAR\leq 7.5$) over a range of angle of attack ($0^\circ\leq\alpha\leq 14^\circ$) reveal streamwise vortices, which increase in strength and number to occupy an increasing spanwise extent with increase in α . Unlike the prediction from the Lifting Line Theory (LLT) by Prandtl, they result in non-monotonic spanwise variation of local force coefficients for $\alpha>8^\circ$. Vortex shedding, for $\alpha=14^\circ$, is single cell and parallel for $sAR<3$. Shedding is in two cells with oblique angle that varies with time, leading to large spanwise variation in rms of local force coefficients for higher sAR .

BIOSKETCH: Sanjay Mittal received his undergraduate education in Aeronautical Engineering at the Indian Institute of Technology Kanpur, India. He went to the University of Minnesota, Minneapolis, USA for his graduate education. Presently, he is a Professor in the Department of Aerospace Engineering at Indian Institute of Technology Kanpur, India. His research interests include fluid-structure interactions, flow-induced vibration, bluff body flows, aerodynamic shape optimization, shock-boundary layer interactions, high performance computing, modeling of traffic flow, sports aerodynamics and low speed wind-tunnel testing. He is an active badminton player and his love for sports has found its way in his research. He is passionate about teaching, and recently received the Excellence-in-Teaching Award and the Gopal Das Bhandari Distinguished Teacher Award from his Institute. He is a Fellow of the Indian National Academy of Engineering, Indian National Science Academy, Indian Academy of Sciences and National Academy of Sciences. He received the prestigious Shanti Swarup Bhatnagar Prize in Engineering Sciences, in 2006.