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Hovering micro air vehicles: Challenges and opportunities

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Rotary-wing- and flapping-wing-based configurations have emerged as possible choice for hovering Micro Air Vehicles (MAV). The rotary-wing systems have proven successful in the high Reynolds number regime (>10^6), where inertial forces dominate flow characteristics. In the low Reynolds number regime ((<10^4) that scales flight physics of MAVs, it is not clear which solution is more efficient. Because of our many years of experience and knowledge base in aeromechanics of rotary-wing systems, it is apparent for a wide development/acceptance of rotor-based MAVs at this time. However, the inspiration from nature tends towards flapping-wing systems as small birds/insects fly elegantly in a range of difficult flight environments. On the other hand, the design tools, fabrication techniques and aeromechanics phenomena related to flapping-wing systems are in their embryonic state. Hence at this stage, it may be prudent to examine the flow physics and development of both hovering MAV concepts. To develop such vehicles, challenges include: low Reynolds number aerodynamics, low altitude environment (gust and obstacles), size and weight constraints, compact power source and distribution, micro actuators/sensors, strong aero elastic couplings, fabrication of micro-joints and mechanisms, and stringent navigational/guidance requirements. The objective of this presentation is to cover the state-of-art on design concepts and aeromechanics of both types of MAVS and identify key barriers and needs for future research.

Biography

Inderjit Chopra is the Alfred Gessow Professor in Aerospace Engineering and Director of Alfred Gessow Rotorcraft Center at the University of Maryland. His research covers rotorcraft aeromechanics, micro air vehicles and smart structures and has co-authored 190 archival papers and 350 conference proceedings papers. His graduate advising resulted in 43 Ph.D. and 83 M.S. degrees. He is a Fellow of *AIAA*, *AHS*, *ASME*, and *Aero Society of India*, and an Honorary Fellow of *AHS*.

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