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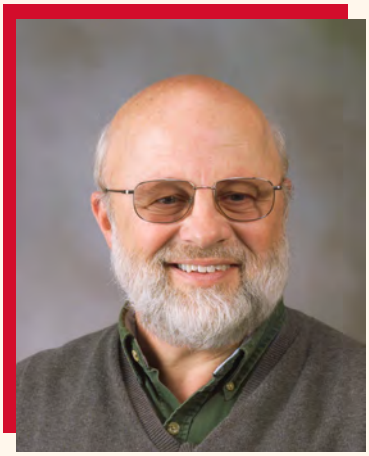
Avian Inspired Flight



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ABSTRACT:

Gliding birds perform some interesting non-aircraft like shapes with their wings and tails. Birds also respond to gusts in unique ways. These observations have motivated the study of shape changing, or morphing aircraft. Several unique uses of piezoceramic composites and shape memory alloys to achieve unique airfoil shapes are presented inspired by the incredible performance avian species achieve. The aerodynamics and control that birds use in gliding result in efficiencies in performance not yet realized by fixed wing aircraft. With the advent of smart, multifunctional composites, it is possible to implement motions inspired by avian gliding in small, unmanned air vehicles (UAV). Initially motivated by the casual observation of flight control motions made by birds, morphing research has proceeded with only limited understanding of how and why birds use their aerodynamic surfaces for flight control and gust alleviation. In addition, previous research has not made use of the full spectrum of active materials. A summary of relevant previous results from two fields: avian biology and morphing aircraft, is presented followed by some current results on morphing trailing edge research and rudderless yaw control. If time permits some results on the computing required for real time control will be addressed as the way forward.

BIOGRAPHY:

Daniel J. Inman received his Ph.D. from Michigan State University in Mechanical Engineering in 1980 and is the Harm Buning Collegiate Professor of former Chair of the Department of Aerospace Engineering at the University of Michigan, Since 1980, he has published eight books (on vibration, energy harvesting, control, statics, and dynamics), eight software manuals, 20 book chapters, over 400 journal papers and 650 proceedings papers, given 64 keynote or plenary lectures, graduated 67 Ph.D. students and supervised more than 75 MS degrees. He works in the area of applying smart structures to solve aerospace engineering problems including energy harvesting, structural health monitoring, vibration suppression and morphing aircraft. He is a Fellow of AIAA, ASME, IIAV, SEM and AAM.