Prof. Atul Kelkar  
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4:00 p.m. / 202 Reed McDonald Building  

Stability Augmentation and Health Monitoring of Aircraft Using Innovative Sensory Feedback

ABSTRACT

With increasing number of aging aircraft and higher levels of complexity in NextGen air transportation systems, aircraft safety is of paramount importance than ever. NASA and FAA are actively pursuing new and innovative technologies that can improve aircraft safety by proactively mitigating current and future risks. The vehicle system safety technology programs by both agencies are focused on developing technologies needed to avoid, detect, mitigate, and recover from adverse flight conditions, and to maintain vehicle airworthiness and health.

Dr. Kelkar’s research team in collaboration with local aerospace industries has been working on the development of innovative methodologies that will enhance the aircraft safety and performance by enabling prognostic determination of incipient failures, improving pilot alert systems through effective cockpit displays, and providing stability augmentation to gracefully recover from adverse flight conditions and avoid potential failures due to loss of control situations. The talk will present a pioneering feedback system architecture, namely FLASH (Flush air data for Aerodynamic and Structural Health Monitoring), a novel architecture that integrates flush air data feedback, structural strain sensing, and reconfigurable control to yield an intelligent, prognostic, on-line stability augmentation, and health & efficiency monitoring system with effective pilot alert mechanisms.

The design, functionality, and validation of various modules of FLASH is accomplished through rigorous computational studies, wind tunnel tests, and comparison with flight test data obtained from Fouga CM-170 experimental category aircraft. A proof-of-concept study will be presented to demonstrate the FLASH system’s capability using selected aircraft health degradation and/or failure situations. The potential benefits of the proposed system concept will be demonstrated using preliminary results obtained through simulation of representative flight scenarios for a facsimile of Boeing 747 aircraft configuration.

BIO
Dr. Kelkar is a Professor of Mechanical Engineering at Iowa State University and prominent scholar in the area of Dynamic Systems and Control. Dr. Kelkar received his Ph.D. degree in Mechanical Engineering from Old Dominion University, Norfolk, Virginia, in 1993 while working as a Research Scientist at NASA Langley Research Center, Hampton, VA. Dr. Kelkar joined Iowa State University in 2001 and currently holds the position of Professor in Mechanical Engineering Department.

Drinks will be served at 3:45 p.m.