Aerial Vehicle Development: Dynamics and Aeroservoelasticity Perspectives

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May 17, 2017

Abstract

The design cycle of a generic modern civil jet* from the perspectives of dynamics and aeroservoelasticity disciplines is presented. The stages of building a representative aeroservoelastic finite element model suitable for stability and dynamics analyses are briefly discussed. A brief overview of industry standard dynamics and quasi-static aeroservoelastic stability analysis is presented. The important topic of the integration of the control laws of the fly-by-wire system into modern aircraft aeroelastic analysis is highlighted. Also, the need for the inclusion of unsteady aerodynamic correction factors when developing control laws and performing aeroservoelastic analysis is emphasized. Furthermore, the experimental correlation of the aircraft engineering model through ground vibration and aeroservoelastic flight testing is discussed. Based on the industrial and the research experiences, two research projects are proposed. The first project addresses the development of control laws that incorporate the flexibility of the airframe and unsteady aerodynamic corrections during all design loops. The second project proposes to numerically and experimentally investigate nonlinear insect flight as applied to miniaturized Unmanned Aerial Vehicles in terms of modelling the associated unique flow regime, developing control strategies and constructing prototypes.

*All proprietary and confidentiality agreements with Bombardier Aerospace are respected.

Speaker Biography

Dr. Fidel Khouli obtained his Ph.D. in Aerospace Engineering from Carleton University and his M.Eng, and B.Eng from the University of Toronto and McMaster University respectively. In July 2009, he joined Bombardier Aerospace as an engineer in Core Engineering - Dynamics and Aeroservoelasticity Group to work on the design and the development of business and regional jets, a position which he still holds. Presently, he is also a part-time instructor at Concordia University, Department of Mechanical and Industrial Engineering. His research interests are in applied dynamics, mathematical modelling of unique flow regimes, control engineering and mechatronics with emphasis on applications to aerospace engineering systems.