VIDEO ARTICLE

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Structural Modeling New Methodologies for Morphing Wings

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Abstract

In two main projects on morphing wing green aircraft technologies, a morphing wing was designed and manufactured with the aim to improve its aerodynamic performances, therefore to reduce the airflow drag, and to delay the flow transition from laminar to turbulent, therefore the fuel consumption. The morphing wing was equipped with piezoelectric pressure sensors. These sensors were used to measure, and thus to compare their experimental values on the morphing wing with their numerical values obtained using different computational fluid dynamics methodologies. Thus, an important number of optimized shapes were obtained for flow cases characterized by flow parameters, such as Reynolds and Mach numbers, and by angles of attack. The morphing wing shapes were changed using different types of actuation systems, as detailed for each sub-project: 1) classical wing-box equipped with smart material actuators, and 2) regional jet wing-tip equipped with in-house electrical actuators. The wing-tip was composed of a wing and an aileron. In this work, the materials used for the modeling and testing of both morphing wings will be discussed. The multidisciplinary (aerodynamics, structural and controls) research methodologies and results will be presented. Both projects were realized in collaboration with Canadian aerospace companies Bombardier and Thales; the second project was international and took place also in collaboration with Italian teams from University of Naples and CIRA. In both projects, wind tunnel tests took place at the IAR-NRC. The numerical results obtained in this project were validated with experimental results obtained following wind tunnel tests at the IAR-NRC.

Biography of Presenting Author

Ruxandra Botez is Full Professor, and Head of the Laboratory of Applied Research in Active Controls, Avionics and AeroServo Elasticity LARCASE at the ÉTS in Montreal, Canada since 2003. Dr Botez is the Canada Research Chair Tier 1 in Aircraft Modeling and Simulation Technologies since 2011. She obtained her Aerospace Engineer degree from the Faculty of Aerospace Design in Bucharest, Romania in 1984, and she has Aerospace Engineering experience acquired in two Aerospace companies: IAR-Brasov in Romania (1984-1987), and Bombardier Aerospace in Montreal (1994-1996).

She obtained her PhD in 1994 from McGill University and her master's in applied sciences degree in 1989 from École Polytechnique in Montreal, Canada. Dr Botez is Associate Fellow of the AIAA and CASI. She is also the Editor-in-Chief of the National Institute for Aerospace Research Elie Carafoli INCAS Bulletin.

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