6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

AEROELASTIC ANALYSIS OF HIGHLY FLEXIBLE WINGS: A COMPARISON OF HIGH AND LOW FIDELITY STRUCTURAL MODELS

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Key Words: *Aeroelasticity, nonlinear geometry, beam elements, shell elements, fluid-structure interaction.*

The aeroelastic modelling of highly flexible aircraft is a rapidly developing field, with a surge in demand driven by the desire to reduce costs and emissions by reduction of induced drag, which can be achieved by increasing the aspect ratio of the wings, leading to highly flexible aircraft. The problem with highly flexible aircraft is that their deflections become large enough that geometrically nonlinear effects become significant. Thus, there is a need for geometrically nonlinear structural wing models to accurately predict their aeroelastic behaviour. However, due to the higher computational cost of geometric nonlinear analysis, aeroelastic models for highly flexible aircraft often use low-fidelity nonlinear beam elements to represent the structure. Therefore, the aim of this paper is to compare the aeroelastic behaviour of a wing using a beam model with the behaviour of a high-fidelity structural model using shell elements. To perform aeroelastic analysis, the structural models are coupled with a vortex lattice method model. Thus, insights will be provided upon the relative accuracy between the two structural models, along with their computational time and any implementation decisions or issues encountered along the way.