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Title: Numerical prediction of flow instabilities and aeroelastic effects

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Abstract:

Two lines of investigation being undertaken at Monash University and of relevance to the aeronautics industry will be presented. First, the prediction of vortex breakdown, a fluid structure that bedevils high angle of attack aircraft but may assist the breakup of tip vortices, has been undertaken using an in-house parallelized spectral element code. Issues of breakdown mode (bubble vs spiral) and validation with flow visualisation will be discussed. Second, aeroelasticity has been identified as one of the most important problems presently facing the designers of turbomachinery blades as well as aircraft control surfaces. A 3-dimensional solver implementing the compressible Navier-Stokes equations coupled with the k-w turbulence model has been developed to solve the unsteady flow through oscillating annular or linear turbine cascades. Simulations have been performed in parallel in a time accurate manner using a Jameson type dual time Runge-Kutta scheme. This is then used to investigate the effects of 3-dimensionality and secondary flows on the unsteady aerodynamics and flutter characteristics of turbine cascades.