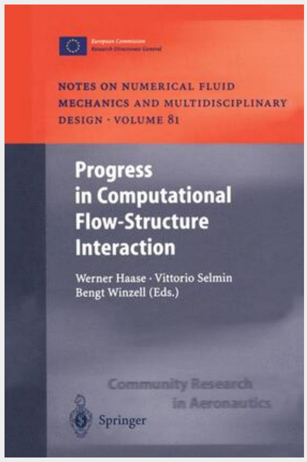
Haase / Winzell / Selmin

Progress in Computational Flow-Structure Interaction

Results of the Project UNSI, supported by the European Union 1998 ¿ 2000



Aircraft design processes require extensive work in the area of both aerodynamics and structure, fonning an environment for aeroelasticity investigations. Present and future designs of European aircraft are characterized by an ever increasing aircraft size and perfonnance. Strong weight saving requirements are met by introduction of new materials, leading to more flexible structure of the aircraft. Consequently, aeroelastic phenomena such as vortex-induced aeroelastic oscillations and moving shock waves can be predominant and may have a significant effect on the aircraft perfonnance. Hence, the ability to estimate reliable margins for aeroelastic instabilities (flutter) or dynamic loads (buffeting) is a major concern to the aircraft designer. As modern aircrafts have wing bending modes with frequencies that are low enough to influence the flight control system, demands on unsteady aerodynamics and structural analysis to predict flight control effectiveness and riding comfort for passengers are extremely high. Therefore, the aircraft industries need an improved capacity of robust, accurate and reliable prediction methods in the coupled aeroelastic, flight mechanics and loads disciplines. In particular, it is necessary to develop/improve and calibrate the numerical tools in order to predict with high level of accuracy and capability complex and non-classical aeroelastic phenomena, including aerodynamic non-linearities, such as shock waves and separation, as well as structural non-linearities, e. g. control surface free-play. Nowadays, robust methods for structural analysis and linearised unsteady aerodynamics are coupled and used by the aircraft industry to computationally clear a new design from flutter.

This volume contains results gained from the EU-funded, 4th Framework project, UNSI (Unsteady Viscous Flows in the Context of Fluid-Structure Interaction). 15 European organisations, industry, research, and universities, have collaborated on the topic of non-linear, static and dynamic aeroelasticity applications with some special emphasis on the improvement of CFD methods applied to unsteady flow. Hence, the book is split into five main parts. Presented are a project description (with points of contact for the interested reader), summaries of work performed by each partner, summaries of work carried out in the work tasks, an application-oriented synthesis, and last but not least a section with conclusions and lessons learnt.

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