11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

NON-DETERMINISTIC AERODYNAMIC SIMULATIONS WITH RANDOM INPUTS

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Key words: *CFD, UQ, 2D, RANS, Polynomial Chaos, Stochastic Collocation, Adaptivity, Geometrical & Operational Uncertainties, Turbulence Models Effect.*

The impact of input data lack of knowledge on CFD simulations may be addressed through uncertainty quantification techniques. The identification of realistic uncertainties is the essential requisite. Subsequently, the appropriate stochastic approximation has to be identified. Non-intrusive techniques, taking advantage of (generalized) polynomial chaos and stochastic collocation approximations [1, 2], are preferred in order to avoid costly code modifications of the flow solver. The study of the turbulent flow about 2D profiles at Reynolds number up to 2 million, subsonic Mach number and at attached and detached conditions is addressed. The analysis takes into consideration simultaneously several operational and geometrical uncertainties. Realistic random inputs from wind-tunnels and real flight data are employed. In this probabilistic framework, the impact of different turbulence models on the global aerodynamic functions of interest is assessed. A comparison between (generalized) polynomial chaos and stochastic collocation methods [3] efficiency is given as well. RANS solution reliability is improved with respect to experimental evidence.

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