9th International Conference on Coupled Problems in Science and Engineering (COUPLED 2021)
13-16 June 2021, Chia Laguna, Sardinia, Italy

HIGH-FIDELITY METHODS FOR FLUID-STRUCTURE INTERACTION AND AEROELASTICITY

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Key words: Fluid-Structure interaction, High-fidelity simulation, Spectral/hp element, Computational Fluid Dynamics, Aeroelasticity

ABSTRACT

Fluid-Structure interaction (FSI) is a Multiphysics problem in which the fluid flow and deformable structure interacting and influencing the motion and dynamics of each other as well as the coupled system. Fluid-structure interaction is frequently encountered in nature, inside human body and in engineering problems. Examples of such FSI phenomena are deformation of trees branches during windy days, deformation of wing of flying birds, deformation of blood vessels wall, vortex induced vibration (VIV) of wind turbine blades, aeroelasticity of flexible wings and VIV of parachute cables to name a few. Analysis of such FSI problems can provides a deeper understanding of the underlying physics, provides new ideas from studying the nature for innovative designs, helps to understand the mechanism of several diseases as well as it is a critical step in engineering problems that involves FSI for both optimal design and prevent failure of the system.

High-fidelity numerical simulations are among few approaches that can provide detailed information for design and analysis of FSI problems. Such high-fidelity simulations are challenging due to structural high flexibility, low density ratio of two mediums and especially turbulent flows with high-Reynolds numbers and separated flows which are the common situation in many engineering applications such as aeroelasticity of wind turbines and flexible flyers.

This session is focused on the recent advances in high-fidelity methods for simulation of FSI simulations and in broad sense will address efficient simulation and coupling algorithms, high Reynolds number turbulent flows, highly flexible structural motions and HPC in FSI simulation as well as their application in aeroelasticity, flexible flyers, wind energy, biomechanics and related topics.