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Séminaire IMFT - Amphithéâtre Nougaro

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Numerical Simulation and Physical Modelling in the Context of Fluid-Structure Interaction

The Institute of Fluid Mechanics and Engineering Acoustics (ISTA) has over 23 years experience in computational fluid dynamics (CFD) and 9 years in computational aero acoustics (CAA, FW-H). In the CFD-field, the focus of recent research activities has moved from statistical (RANS) to deterministic (LES) and hybrid RANS-LES techniques. In particular, extensive experience has been gained with state-of-the-art extensions of the original DES method, such as DDES, which avoids the problem of grid induced separation and IDDES, which extends the DES approach to weakly separated or even attached flows.

Many realistic CFD applications, such as landing gears or the air flow in a human lung feature complex geometries. Furthermore, CFD is nowadays accepted as a mature and reliable tool for flow prediction ready for application in multi-disciplinary contexts such as fluid-structure interaction.

For this reason the ISTA is continuously working on the numerical simulation of fluid-structure interaction, with activities ranging from fundamental investigations (e.g. grid deformation algorithms, coupling methods, flexible riblets for drag reduction) to applications with practical relevance (e.g. aeroelastic analysis based on fully coupled CFD/CSM).

Current investigations at the ISTA are concerned with the CHIMERA technique and the Immersed Boundaries (IB) method, which are promising concepts for capturing complex moving/deforming geometries. In contrast to grid deformation techniques, the CHIMERA and IB methods allow for arbitrary movement and strong deformation whilst maintaining grid quality, since they do not require a re-generation of the numerical mesh. Furthermore, they can be easily combined e.g. with an FEM solver and are therefore perfectly suited for the application to fluid-structure interaction.

The CHIMERA and IB technique as well as the approaches for turbulence treatment described above are implemented in the highly capable in-house flow solver, which is continuously developed and validated at ISTA and has been applied to a wide range of academic as well as complex flow configurations.

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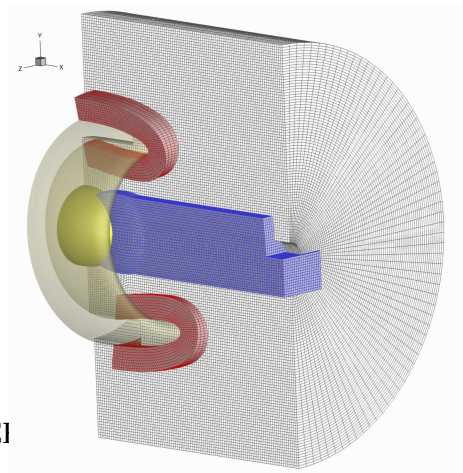

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