

HiWi position

for students of Mechanical Engineering, CES, SiSc, etc.

Computational Fluid Dynamics for Rotating Machinery

Computational Fluid Dynamics (CFD) has become a valuable tool to simulate fluid flow in a wide range of engineering applications. In case of rotating machinery, e.g., helicopters, wind turbines, blood pumps, and stirred-tank bioreactors, special methods are required to update the mesh in response to the rotation. For the mesh update method we are implementing, the mesh consists of essentially three components: an inner rotating region (*helicopter rotor*), an outer inertial region (*helicopter fuselage and surroundings*), and a thin layer in between. In this context, we need to find a systematic way to create such meshes for various applications and test the implementation on select cases.

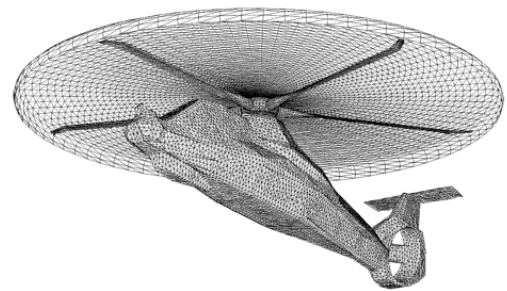


Fig. 1: Rotating mesh around helicopter blades.

What we offer

Creating high-quality meshes is an essential step for many applications of computational engineering and thus a valuable skill in research and industry. Additionally, you will learn about the object-oriented structure of our modern finite element multiphysics solver XNS. It enables high-fidelity fluid simulations on complex geometries. This way, you will get an impression of how state-of-the-art simulation methods are employed in computational engineering, particularly for medical devices, like blood pumps, and for bioreactors.

Your tasks will consist of:

- Meshing three-dimensional rotating machinery
- Preparing meshes for simulation in our solver
- Setting up and running CFD simulations

Prerequisites

- Interest in CFD and meshing software
- Programming skills, preferably Python
- Knowledge of FEM and/or meshing is a bonus

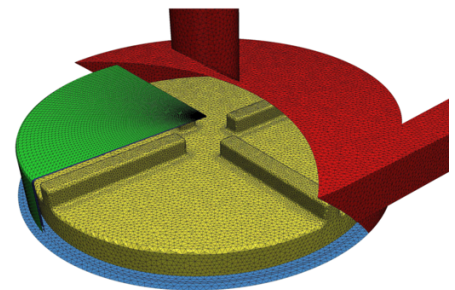


Fig. 2: Rotating mesh around blood pump impeller.

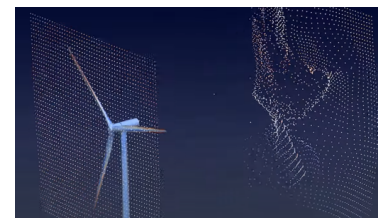
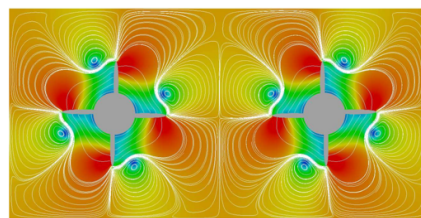
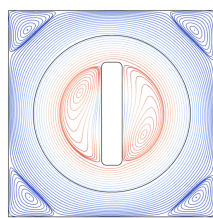
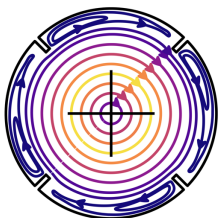


Fig. 3: Examples of flow fields around rotating machinery.

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