

Master's Thesis:

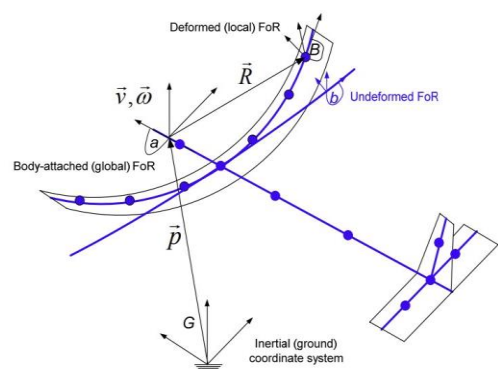
Development of a Radial Basis Function (RBF) Based Beam Mapper for Coupled Aeroelastic Simulations

In partitioned aeroelastic simulations, the accurate exchange of deformation and load data between non-matching meshes is critical. To reduce computational cost, complex structural components such as aircraft wings are often simplified to beam models that capture their dominant bending and torsional behavior. However, this simplification introduces challenges in mapping displacements and rotations between the structural beam representation and the high-fidelity aerodynamic surface mesh.

This thesis aims to develop and validate a Radial Basis Function (RBF)-based beam mapper that incorporates both translational and rotational degrees of freedom, enabling a more accurate reconstruction of aerodynamic surface deformations from beam-like structural models.

The steps for completing this task are:

- Understand the architecture and workflow of the MappingApplication in Kratos;
- Derive and implement the RBF beam mapper with rotational recovery;
- Validate the method using analytical deformation fields;
- Compare its performance against the existing co-rotational beam mapper in terms of accuracy, stability, and computational cost;
- Assess the range of applicability of the RBF beam mapper with respect to deformation magnitude



Some basic knowledge on Fluid-Structure Interaction and Mapping Techniques is beneficial and basic knowledge in C++ and Python are essential for the implementation in the open-source framework Kratos Multiphysics.