FRIEDRICH-ALEXANDER
UNIVERSITÄT
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TECHNISCHE FAKULTÄT

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Studentische Arbeiten am Lehrstuhl für Technische Mechanik

Projekt- / Bachelor- / Masterarbeit

Force and torque interactions between rigid bodies and fluid flow

Based on the computational fluid dynamics software OpenFoam set up a three-dimensional computational domain for fluid flow around a rigid body of a given shape. Compute resulting reaction forces and torques as functions of inflow conditions and the angular velocity of the rigid body. Perform a parametric study by considering spherical, ellipsoidal, and generically shaped rigid bodies. Compare the computed force and torque laws with empirical models available for laminar flow conditions.

Projekt- / Bachelor- / Masterarbeit

Inertia properties of non-homogeneous rigid bodies

The inertia properties of non-homogeneous rigid bodies are characterized by their density distribution and are captured by their barycentre, mass and moment-of-inertia tensor. These follow from integrals evaluated over the geometry of the rigid body. Develop a code (e.g. in MatLab) that computes the inertia properties of rigid bodies based on their Finite Element discretization. Perform a parametric study by considering spherical, ellipsoidal, and generically shaped rigid bodies with various non-homogeneous density distributions. Where possible compare with known solutions.

Projekt- / Bachelor- / Masterarbeit

Rigid body tracking algorithm

For given inertia properties and histories of applied forces and torques the motion of rigid bodies follows from integrating the equations of motion by Newton and Euler. These integrations shall be performed computationally by time integration or rather tracking algorithms. Implement various time integration algorithms for rigid bodies. Evaluate their accuracy (e.g. by varying the time step size), compare to analytical solutions and assess their computational cost. Extent the algorithm to the parallel treatment of many non-contacting rigid bodies.