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Computational Mechanics & Advanced Materials

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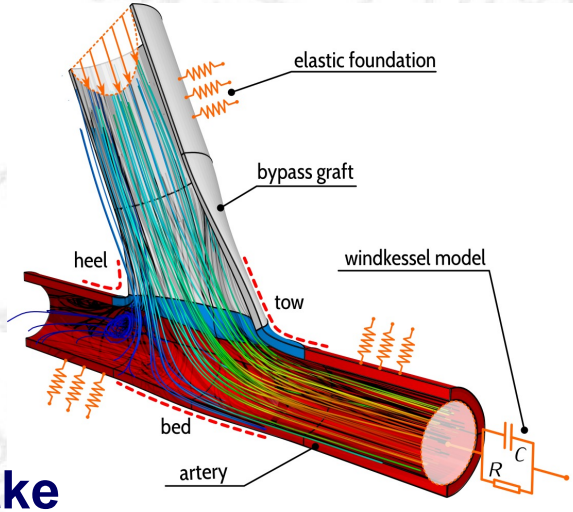
SEMINARIO

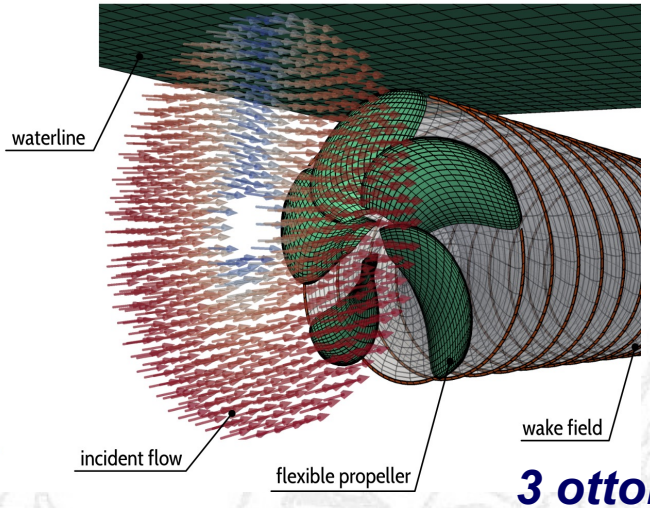
Partitioned fluid-structure interaction: solution approaches, applications, optimization

Partitioned solution approaches for fluid-structure interaction (FSI) problems enable the use of dedicated solvers for the individual sub problems. We employ high-order finite elements (FE) on the structural side to realize locking-free simulations of nearly incompressible and thin-walled solids. On the fluid side, finite volumes (FV) are used as the preferred discretization method. Further, boundary elements (BE) are used if the characteristics of the flow fit such a modeling approach.

This allows for a wide range of applications ranging from biomechanics to maritime engineering. The presentation focuses on two examples in this regard, namely the hemodynamics (blood flow) in arterial bypass-grafts and the acoustic behavior of marine propellers. Especially the former demands for novel convergence acceleration schemes in order to stabilize the implicit coupling iterations, while the latter may also be treated using explicit approaches.

Building on a continuous adjoint method, shape optimization problems can be approached using the partitioned solution approach as well. We have achieved first results in this context for the minimization of the dissipated power in ducted flows. While this can be regarded a well established objective function in classical fluid mechanics, the application to FSI poses several challenges such as a proper coupling of the adjoint problem and the design of suitable benchmark cases.





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