Fluid-Structure Interaction in Maritime Applications: Towards Partitioned Coupling Simulation of Wind-Sail Interaction

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ABSTRACT

Numerical simulations play a crucial role in the design of various maritime applications, for example, the simulation of ocean energy harvesting systems and ship propellers. To study the complex behavior of these devices, multi-field problems must be addressed. These problems model the interaction between different sub-problems. In the maritime context, multi-field simulations can be used to study the interaction between the flow of a fluid and the deformation of a structure. Examples are the interaction between the water and a propeller or the wind and the sail of a sailing ship. A partitioned coupling approach can be employed to solve these problems. This allows for the use of existing simulation software tailored to specific domains, enabling each sub-problem to be solved individually.

Different numerical techniques are required to efficiently couple the specialized solvers. In this presentation, we concentrate on the necessary partitioned coupling techniques, including the coupling algorithm and the tasks required therein, like accelerating the coupling iteration and performing reliable interpolations between the coupling domains. This is done using our in-house developed coupling software *comana* (König et al., 2016). We illustrate the modeling and simulation method by applying it to sail dynamics. Furthermore, we present an enhancement of the modeling approach that allows for the use of three-dimensional high-order solid elements (Düster et al., 2017) to discretize the structure. The fluid problem is solved using a boundary element method (Bauer and Abdel-Maksoud, 2012).

References

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