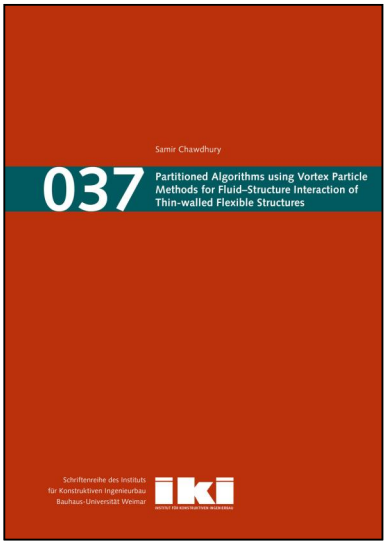
Partitioned Algorithms using Vortex Particle Methods for Fluid–Structure Interaction of Thin-walled Flexible Structures

Structures under wind action can exhibit various aeroelastic interaction phenomena, which can lead to destructive and catastrophic events. Such unstable interaction can be beneficially used for small-scale aeroelastic energy harvesting. Proper understanding and prediction of fluid−structure interactions (FSI) phenomena are therefore crucial in many engineering fields. This research intends to develop coupled FSI models to extend the applicability of Vortex Particle Methods (VPM) for numerically analysing the complex FSI of thin-walled flexible structures under steady and fluctuating incoming flows. In this context, the flow around deforming thin bodies is analysed using the two-dimensional and pseudo-three-dimensional implementations of VPM. The structural behaviour is modelled and analysed using the Finite Element Method. The partitioned coupling approach is considered because of the flexibility of using different mathematical procedures for solving fluid and solid mechanics. The developed coupled models are validated with several benchmark FSI problems in the literature. Finally, the models are applied to several fundamental and application field of FSI problems of different thin-walled flexible structures irrespective of their size.



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