Enhancement of fixed-grid methods towards complex fluid-structure interaction applications

Abstract:

Fixed-grid methods for moving interface problems offer a number of attractive properties and have therefore gained quite some popularity in recent time. However, moving mesh approaches still have their advantages when the physical problem requires special treatment or accurate representation of the interface. This is for example the case in complex fluid-structure interaction problems when state-of-the-art boundary layer meshing is essential. This paper explores two enhancements of fixed-grid methods that allow the improved solution of such complex fluid-structure interaction problems. The two enhancements are: a straightforward approach based on local adaptivity and a hybrid method that combines ideas from fixed-grid methods and Arbitrary Lagrangean Eulerian formulations. Although both enhancements could be used with most available fixed-grid approaches they are given here against the background of a recently developed eXtended Finite Element Method/Lagrange Multiplier [11] fixed-grid method. It is shown that the hybrid scheme perfectly fits into the presented XFEM/LM framework in a consistent way.