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A local refinement based fictitious domain method for the simulation of fluid flow in complex geometries

The simulation of fluid flow in industrial processes often involves geometries that may contain mobile internal parts. The use of classical finite element (or finite volume) methods to tackle such problems is far from trivial since a new mesh is needed at each time iteration owing to the motion of these internal parts. The objective of this work is to combine a fictitious domain method with a mesh refinement technique that relies upon one single reference mesh. The method will be discussed in detail and two-dimensional and three-dimensional applications will be presented. In particular, it will be shown that the proposed strategy is quite efficient for the simulation of fluid flow in geometries with moving parts and small gaps.