

FSI simulation problems with embedded fluid formulation. Application to mud motors simulation and Virtual Wind Tunnel facility.

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ABSTRACT

Commonly, the simulation of Fluid Structure Interaction (FSI) problems uses an Arbitrary Lagrangian Eulerian (ALE) formulation in the fluid domain. This allows the structure interface tracking but might yield large element distortion, which usually requires remeshing, when large displacements occur.

To get rid of this limitation we present the use of an embedded formulation in the fluid domain. The main features of the embedded formulation is that the fluid mesh is fixed and that the interface tracking is done with a signed distance function. This completely avoids mesh distortion, allowing the simulation of large displacement FSI problems.

The show the capabilities of the presented formulation it has been applied to the simulation of mud motors. Mud motors are progressive cavity positive displacement pumps (PCPD) used in the drilling industry to increase the power of the drilling bit. The presented formulation is capable of dealing with the large displacements arising from the mud motor inner rotation that produces the power.

Advances towards the development of a Virtual Wind Tunnel (VWT) capable of dealing with large displacement structures will be also shown.

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