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Application of overset mesh for simulating fluid-structure interaction using foam-extend 4.1

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It is presented an extension of the open-source fluid-structure interaction (FSI) toolbox **solids4foam** to enable application of the overset mesh methodology recently implemented in the foam-extend. In the solids4foam toolbox, the fluid flow is described by the Navier-Stokes equations in the arbitrary Lagrangian-Eulerian form, while the momentum equation in the total or updated Lagrangian form is used to describe the solid deformation. Both the fluid and the solid are discretised in space using the second-order accurate cell-centred finite volume method and the second-order accurate implicit scheme is used for temporal discretization. The adjustment of the fluid mesh to the time varying shape of the deformable body is usually carried out by mesh deformation, where the internal mesh vertices are moved based on the prescribed motion of the boundary vertices, while the topology of the mesh stays unchanged. In the overset mesh approach, the fluid mesh is composed of one background mesh and one or more foreground meshes attached to the moving/deforming bodies. Motion of the foreground meshes independently from the background mesh should enable much higher motion amplitudes during FSI simulations. Application of overset mesh in the FSI calculation framework required series adjustments related to the mesh deformation solvers and support for high order temporal discretization schemes.

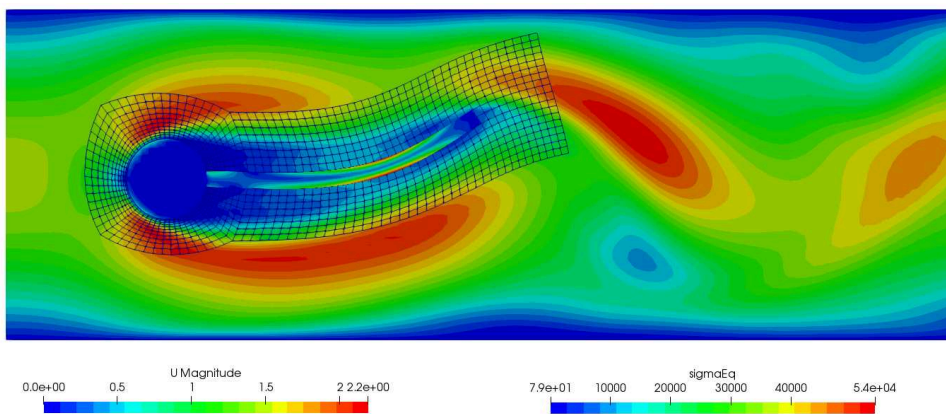


Figure 1: Turek and Hron FSI-2 test case: foreground mesh deformed by RBF mesh motion solver.

Literature

Cardiff, P.; Karač, A.; De Jaeger, P.; Jasak, H.; Nagy, J.; Ivanković, A.; Tuković, Ž (2018): An open-source finite volume toolbox for solid mechanics and fluid-solid interaction simulations. In: Computer Physics Communications, submitted for review. Available online at <https://arxiv.org/abs/1808.10736v2>.

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