FSI Simulation of Pulsatile Blood Flow in Aortic Arch (coupling Abaqus and STAR-CCM+)

[1]

Advanced improvements in coupling methods of solid and ?uid numerical softwares bene?t considerably cardiovascular biomechanics investigations. Deformability of this complicated physiological system plays an important role in bio?uid factors such as Wall Shear Stress (WSS). In the current work, taking advantage of recently developed bi-directional interaction tools between Abaqus and STAR-CCM+, a simulation of physiological pulsatile blood ?ow through aortic arch is implemented. Abaqus solves the computational solid mechanics problem corresponding to the arterial wall while STAR-CCM+ solves the computational ?uid dynamics model of the blood ?ow. Realistic boundary conditions on both models are applied; velocity inlet and pressure outlets in ?uid simulation and in-plane deformation of inlet and outlets are applied on the FEM part of the model. Due to variation in geometry of aortic arch in different individuals, a canonical geometry is adopted for this simulation. Bio?uid parameters such as pressure, velocity and WSS are discussed as the results of the simulation. The importance of FSI modeling in cardiovascular simulations is highlighted by a comparison with the same model but without FSI considerations. This comparison shows differences which are not negligible. A previous model of a straight elastic tube is presented, corresponding to the wave transmission of a pressure pulse at the inlet, comparing the FSI numerical results with the analytical solution for an elastic tube.

Author Company:
Universidad Politécnica de Madrid
Author Name:
D. Afkaria
F. Gabaldóna
Industries:
Products:
Conference:

Links:
[1] http://www.cd-adapco.com/sites/default/files/Presentation/12-madrid_0.pdf