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Parallel Large-Scale Computation of an Oldroyd-B Fluid Past a Confined Circular Cylinder in a Rectangular Channel using an Unstructured Finite Volume Method MEHMET SAHIN, Istanbul Technical University — A new stable unstructured finite volume method is presented for parallel large-scale simulation of viscoelastic fluid flows. The numerical method based on side-centered finite volume method where the velocity vector components are defined at the mid-point of each cell face, while the pressure term and the extra stress tensor are defined at element centroids. The present arrangement of the primitive variables leads to a stable numerical scheme and it does not require any *ad-hoc* modifications in order to enhance the pressure-velocity-stress coupling. The log-conformation representation has been implemented in order improve the limiting Weissenberg numbers in the proposed finite volume method. The time stepping algorithm used decouples the calculation of the extra stresses from the evaluation of the velocity and pressure fields by solving a generalised Stokes problem. The present numerical method is verified for the three-dimensional flow of an Oldroyd-B fluid past a confined sphere in a cylindrical tube. Then the method is applied to the three-dimensional flow of an Oldroyd-B fluid past a confined circular cylinder in a rectangular channel. The computed results at relatively high Weissenberg numbers are discussed and compared to those obtained for Newtonian fluids.

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