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NUMERICAL PREDICTIONS OF VISCOELASTIC FLOWS WITH AN ALGEBRAIC EXTRA-STRESS MODEL

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Numerical simulation of viscoelastic flows using Phan-Thien-Tanner (PTT) [1] differential constitutive equation, and an algebraic extra-stress model (AESM) proposed by G. Mompean [2] are presented in this work. In order to evaluate the perform of the AESM and show that it can cope with complex flows, two problems are studied: fully-developed channel flow and the flow through a 4:1 planar contraction at low Reynolds number. The governing equations are solved using a Marker-and-Cell type method on a staggered grid [3]. The momentum equation is integrated by the implicit scheme while the algebraic PTT equation is solved explicitly by a forward Euler method. The accuracy of the numerical method is verified by comparing numerical results of fully-developed channel flow with the corresponding analytic solutions. The planar contraction problem is employed to assess whether the algebraic model is able to predict the viscoelastic flow displaying the same behavior of the differential PTT model. Moreover, to show the advantages of the algebraic extra-stress model (AESM) over the differential PTT model, a study of the computational effort has been carried out.

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