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PRESSURE-STABILIZED FINITE ELEMENT METHODS FOR VISCOELASTIC FLOW PROBLEMS

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The viscoelastic flow is one of the important physical phenomena both from the theoretical and from the practical points of view. Blood flows in the human body and plastic flows during the injection molding are typical examples of the viscoelastic flow; for more examples and details, see Larson [3], Öttinger [5], and their references. Therefore, there encounter many researches on the numerical analysis and simulation of viscoelastic flows; see, for example, Bonito–Clement–Picasso [1], Owens–Phillips [6], and their references.

In order to enhance the mathematical justification of numerical methods for viscoelastic flows, we establish error estimates of a pressure-stablized finite element method for ones. Moreover, we show some numerical examples of contraction flows, and compare numerical results with experimental ones among some viscoelastic models; the Oldroyd-B model [4], the Giesekus model [2], and the PTT model [7].

Figure 1 shows an example of the comparisons; the stream lines of the 4 to 1 contraction flow among the Stokes, the Oldroyd-B, the Giesukus, and the PTT models.

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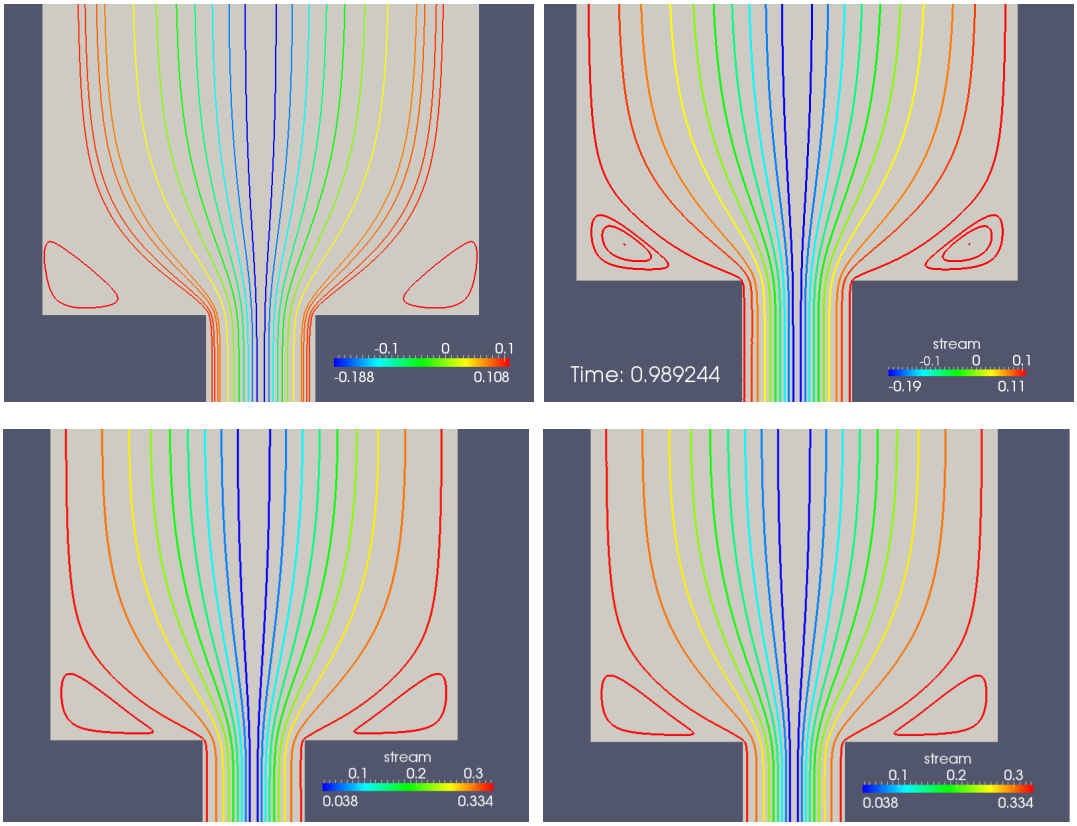

Figure 1: Stream lines of the 4 to 1 contraction flow (Above–Left: the Stokes model; Above–Right: the Oldroyd-B model; Below–Left: the Gieskus model; and Below–Right: the PTT model).

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