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Modelling of Polymeric Fluid Flows between Two Coaxial Cylinders Taking into Account the Heat Dissipation

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Abstract : Mathematical model based on the mesoscopic theory of polymer dynamics is developed for numerical simulation of the flows of polymeric liquid between two coaxial cylinders. This model is a system of nonlinear partial differential equations written in the cylindrical coordinate system and coupled with the heat conduction equation including a specific dissipation term. The stationary flows similar to classical Poiseuille ones are considered, and the resolving equations for the velocity of flow and for the temperature are obtained. For solving them, a fast pseudospectral method is designed based on Chebyshev approximations, that enables one to simulate the flows through the channels with extremely small relative values of the radius of inner cylinder. The numerical analysis of the dependance of flow on this radius and on the values of dissipation constant is done.

Keywords : dynamics of polymeric liquid, heat dissipation, singularly perturbed problem, pseudospectral method, Chebyshev polynomials, stabilization technique
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