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Non-Newtonian flows of power-law fluid cross a square cylinder placed symmetrically in a plane channel

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Abstract

The aim of this work is to present a numerical study of non- Newtonian flows of power-law fluid across an unconfined square cylin- der at two inclination angles, placed symmetrically in a two-dimensional channel. This work develops a least-squares finite element method which offers a direct approximation of the extra stress tensor com- ponents, a symmetric positive definite system, and the openness of choosing finite element spaces. We prove that the least-squares ap- proximation converges to linearized solutions of the non-Newtonian model at the optimal rate. We demonstrated that numerical results agree with the theoretical estimates and present the effects of physical parameters on the physical attributes of the power-law model, such as drag coefficients, stream function, vorticity, and wake length. These results agree with others published in the literature.