Reduced order modeling of time-dependent generalized Newtonian fluid flows

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This work numerically evaluates the accuracy and performance of a stabilized finite element Reduced Order Modelling (ROM) approach designed to simulate time-dependent generalized Newtonian fluid flows. The method estimates off-trained parametric scenarios not included in the training data set composing the ROM basis and can adopt arbitrary values from other specific fluid and flow conditions. Also, a mesh-based hyper-reduction technique is included. The numerical testing includes approximating well- established benchmark solutions of shear-thinning and shear-thickening fluid flows to demonstrate the method's robustness. Furthermore, the application of the method in two engineering problems related to hemodynamic and conjugate thermally coupled flows is presented. Numerical results evidence the method's capability, accuracy, and performance to approximate complex flow conditions of generalized Newtonian fluids.

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