# Simulation of viscoelastic fluid flows using stabilization technique

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**Abstract**

The challenge for computational rheologists is to develop efficient and stable numerical schemes in order to obtain accurate numerical solutions for the governing equations at values of practical interest of the Weissenberg number. One of the associated problems for numerical simulation of viscoelastic fluids is that the accuracy of the results when approaching critical values at which numerical instabilities occur is very low and refining the mesh proved to be not very helpful. In order to investigate the numerical instability generation a comprehensive study about the growth of spurious modes with time evolution, mesh refinement, boundary conditions and Weissenberg number or any other affected parameters is performed on the planar Poiseuille channel flow. To get rid of these spurious modes the filter based stabilization of spectral element methods proposed by Boyd (1998) is applied. This filter technique is very useful to eliminate spurious modes for one element decomposition, while in the case of multi-element configuration, the performance of this technique is not ideal. Since the performance of filter-based stabilization of spectral element acts very well for one element decomposition, a possible remedy to solve the associated problem of multi-element decomposition is mesh-transfer technique which means: first mapping the multi-element configuration to one element configuration, applying filter-based stabilization technique to this new topology and hereafter transferring the filtered variables to the original configuration. This way of implementing filtering is very useful for the Oldroyd-B fluids when a moderate number of grid points is used.

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