Numerical simulations of an incompressible piezoviscous fluid flow in a plane slider bearing

Martin Lanzendorfer,
Charles University Prag
Czech Republic
(Joint work with J. Malek and K. R. Rajagopal)

We present numerical simulations of an incompressible pressure-thickening and shear-thinning lubricant in a plane slider bearing, studying the steady isothermal flow without resorting to the lubrication approximation. The finite element approximations will be found as long as the variation of the viscous stress $\boldsymbol{S} = 2\eta\boldsymbol{D}$ with the pressure p is limited, say $|\partial\boldsymbol{S}/\partial p| \leq 1$. In particular, we document thoroughly that the eventual practice to avoid the numerical difficulties by cutting the viscosity off for large pressures leads to results that depend sorely on the artificial cut-off parameter. We observe that the piezoviscous rheology generates pressure differences across the fluid film. Some comments on the boundary conditions on the two artificial boundaries, related to the plane slider bearing problem, will be included.