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A Reynolds lubrication equation for dense fluids valid beyond Navier-Stokes[1] NISHA CHANDRAMOORTHY, NICOLAS HADJICONSTANTINOU, MIT — Based on an approach for describing wave propagation in narrow channels, originally attributed to Lamb, we develop a method for extending the Reynolds Lubrication approximation to small scales for which the Navier-Stokes constitutive closures fail. The basic idea behind this approach is that the Reynolds equation is an averaged description of mass conservation and thus does not involve spatially resolved flow profiles in the transverse (gap) direction. In other words, the constitutive information required is significantly simpler and is limited to the *local* flowrate as a function of the gap height. Such a constitutive relation is significantly easier to obtain by experiments and/or off-line molecular simulations of pressure driven flow in constant height channels in which other control parameters of the flow rate are held constant. Using this constitutive equation results in a Reynolds-type equation that enables continuum modelling of lubrication problems at any lengthscale. The proposed methodology is demonstrated and validated for a nanoscale lubrication problem by comparison to Molecular Dynamics simulations.

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