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Effect of Biofilm Deformation on Detachment, Mass transfer and Growth

Bacterial biofilms are microbes growing on surfaces and wetted interfaces in aqueous environments.They form when the cells in the fluid attach themselves to the surface and start to producing an extracellular polymeric matrix, in which the growing bacteria cells embed themselves. This gel like layer protects the embedded bacteria from harmful environmental effects such as anti-microbials and provides mechanical stability to the biofilm to resist detachment.

The mechanical response of the biofilm depends not only on the material property of the biofilm but also on the shape and morphology of biofilm-flow interface. Rheology experiments done over the years by different groups on biofilms grown under different conditions using different measurement techniques have provided differing description of the biofilm response (elastic, viscoelastic solid, viscoelastic fluid) with material parameter values varying over a wide range. Most of the current mathematical models studying biofilm growth and detachment do not account for the deformation of biofilm or do so in an adhoc way to avoid numerical difficulties arising from the fluid structure interaction problem or do not make use of material property values measured from experiments. In our talk, we will present the results from our simulations (1-D as well as 2-D) where we explored how the deformation of the biofilm resulting from different material description affects the detachment forces acting on the biofilm as well as the mass transfer to the biofilm.