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A validated computational model for the design of surface textures in full-film lubricated sliding JONATHON SCHUH, YONG HOON LEE, JAMES ALLISON, RANDY EWOLDT, University of Illinois at Urbana-Champaign — Our recent experimental work showed that asymmetry is needed for surface textures to decrease friction in full-film lubricated sliding (thrust bearings) with Newtonian fluids; textures reduce the shear load and produce a separating normal force. The sign of the separating normal force is not predicted by previous 1-D theories. Here we model the flow with the Reynolds equation in cylindrical coordinates, numerically implemented with a pseudo-spectral method. The model predictions match experiments, rationalize the sign of the normal force, and allow for design of surface texture geometry. To minimize sliding friction with angled cylindrical textures, an optimal angle of asymmetry β exists. The optimal angle depends on the film thickness but not the sliding velocity within the applicable range of the model. The model has also been used to optimize generalized surface texture topography while satisfying manufacturability constraints.

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