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Numerical Studies into Flow Profiles in Confined Lubricant LUCA DI MARE, ALEKS PONJAVIC, JANET WONG, Imperial College London — This paper documents a computational study of flow profiles in confined fluids. The study is motivated by experimental evidence for deviation from Couette flow found by one of the authors (JSW). The computational study examines several possible stress-strain relations. Since a linear profile is the only possible solution for a constant stress layer even in presence of a power law, the study introduces a functional dependence of the fluid viscosity on the distance from the wall. Based on this dependence, a family of scaling laws for the velocity profile near the wall is derived which matches the measured profiles. The existence of this scaling law requires the viscosity of the fluid to increase at least linearly away from the wall. This behaviour is explained at a microscopic level by considerations on the mobility of long molecules near a wall. This behaviour is reminiscent of the variation of eddy length scales in near-wall turbulence.

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