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Thin-film flow on a stationary or uniformly rotating cylinder subject to a prescribed uniform surface shear stress STEPHEN WILSON, BRIAN DUFFY, GAVIN BLACK, Department of Mathematics, University of Strathclyde, Glasgow, UK — We investigate thin-film flow on a stationary or uniformly rotating horizontal circular cylinder subject to a prescribed uniform shear stress at the free surface of the film. For a stationary cylinder we show that the "full-film" solution always has forwards flow, but that both the "curtain" and "shock" solutions always have a region of recirculating flow. For the full-film and shock solutions we calculate the maximum supportable mass. We also show how gravity effects can smooth the shock in the leading-order shock solution for rimming flow but not for coating flow, whereas surface-tension effects can do so in both situations. For a uniformly rotating cylinder there are two different full-film solutions, namely a "Moffatt mode" and a "shear mode", the latter of which is possible only for sufficiently strong shear in the opposite direction to the rotation of the cylinder. We show that the Moffatt mode always has forwards flow throughout the film, but that the shear mode always has a region of recirculating flow. In addition, we calculate the maximum and minimum supportable masses for both modes.

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