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Viscous liquid thin-film flow inside a tube[1] H. REED OGROSKY, ROBERTO CAMASSA, M.G. FOREST, CHRIS JOY, JEEHO KIM, JEFFREY OLANDER, University of North Carolina — Experiments are conducted over a range of parameters where a high-viscosity silicone oil is fed into the top of a vertical thin glass tube. The oil flows at a continuous rate and the resulting gravity-driven flow coats the inside of the tube. Interfacial instabilities develop due to surface tension and azimuthal curvature. Depending on the experimental parameters, the instabilities either saturate and propagate down the tube as traveling waves or form propagating plugs or liquid bridges. Using a long-wave asymptotic model, we compare the growth rates and phase speed predicted by linear stability analysis with those of the experiments, and the fully nonlinear form of the model is used to predict the formation of plugs. Comparison of the model and experiments to its counterpart exterior setup of a gravity-driven film flow coating a fiber will be mentioned. The experiments are then extended to include pressure-driven airflow at a constant flow rate upwards through the center of the tube. The interfacial stress created by the airflow alters the speed and growth rates of the instabilities. The leading-order effects of the airflow are included in the long-wave model, and a comparison is made once again between model and experiments.

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