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Flow regimes and traveling waves for a model of gravity-driven film flows in cylindrical domains.[1] H. REED OGROSKY, Virginia Commonwealth University, ROBERTO CAMASSA, JEREMY MARZUOLA, NATHAN VAUGHN, University of North Carolina — Families of traveling wave solutions will be presented for a model of a falling viscous film on the interior of a vertical rigid tube. Each family contains a single solution at a 'turnaround point' with larger film thickness than all others in the family. It was previously conjectured that this turnaround point may represent a critical thickness separating two distinct flow regimes observed in physical experiments as well as two distinct types of behavior in transient solutions to the model. We will verify these hypotheses over a range of parameter values using a combination of numerical and analytical techniques. The linear stability of these solutions will also be discussed; both large- and small-amplitude solutions will be shown to be unstable, though the instability mechanisms are different for each wave type. Specifically, for small-amplitude waves, the region of relatively flat film away from the localized wave crest is subject to the same instability that makes the trivial flat-film solution unstable; for large-amplitude waves, this mechanism is present but dwarfed by a much stronger tendency to relax to a regime close to that followed by small-amplitude waves.

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