Modeling film flows down inclined planes

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Abstract:

A new model of film flow down an inclined plane is derived by a method combining results of the classical long wavelength expansion to a weighted-residuals technique. It can be expressed as a set of three coupled evolution equations for three slowly varying fields, the thickness h, the flow-rate q, and a new variable τ that measures the departure of the wall shear from the shear predicted by a parabolic velocity profile. Results of a preliminary study are in good agreement with theoretical asymptotic properties close to the instability threshold, laboratory experiments beyond threshold and numerical simulations of the full Navier--Stokes equations.