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Three-dimensional wave patterns in falling films BENOIT SCHEID, Université Libre de Bruxelles, CHRISTIAN RUYER-QUIL, Université Paris-Sud, PAUL MANNEVILLE, Ecole Polytechnique — A large number of studies have been devoted to the modeling of film flows down inclined planes since the pioneering work of Kapitza & Kapitza (1949). Ruyer-Quil & Manneville (2000,2002) have extended the Shkadov formulation (1967) applying weighting residual techniques and expanding the flow field over a complete basis of polynomial functions. Inspired from a Padé-like approximant technique initially proposed by Ooshida (1999), a refined model is now formulated which also includes second-order inertia effects arising from the deviation of the streamwise velocity profile from its parabolic shape. The stability of two- dimensional traveling waves against three-dimensional perturbations is investigated using this model. The secondary instability is found to be not really selective which explains the widespread presence of the synchronous instability observed in the experiments by Liu *et al.* (1995), though theory predicts in most cases a subharmonic scenario. Three-dimensional wave patterns are next computed assuming periodic boundary conditions. Transition from 2D to 3D flows is shown to be strongly dependent on initial conditions. The herringbone patterns, the synchronously deformed fronts, the oblique and the V-shape solitary waves observed in various experimental data (Liu *et al.* 1995; Park & Nosoko 2003; Alekseenko *et al.* 1994) are reliably recovered.

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