Chang, H.-C.; **Demekhin, E. A.**; **Kopelevich, D. I.**
Construction of stationary waves on a falling film. (English) Zbl 0771.76054
Comput. Mech. 11, No. 5-6, 313-322 (1993).

We present a spectral-element method for the title multi-scale free surface problem. A boundary layer approximation of the equation of motion allows a Fourier expansion in the streamwise direction in conjunction with a domain decomposition in the direction normal to the wall that eliminates numerical instability. This mixed method hence enjoys both the exponential convergence rate of a spectral technique and the numerical advantage provided by a compactly supported basis which yields sparse projected differential operators. All stationary wave families, parameterized by the wavelength, are then constructed using a Newton continuation scheme. The constructed waves are favorably compared to experimentally measured wave shapes.

MSC:

76M25 Other numerical methods (fluid mechanics) (MSC2010)
76D10 Boundary-layer theory, separation and reattachment, higher-order effects

Keywords:

spectral-element method; multi-scale free surface problem; boundary layer approximation; Fourier expansion; domain decomposition; convergence; stationary wave families; Newton continuation scheme

Full Text: DOI

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