The effects of surface tension on the initial development of a free surface adjacent to an accelerated plate JAMAL UDDIN, DAVID NEEDHAM, University of Birmingham — When a vertical rigid plate is uniformly accelerated from rest into an initially stationary layer of inviscid incompressible fluid, the free surface will undergo a deformation in the locality of the intersection point between the free surface and the plate. This deformation of the free surface will, in the early stages, cause a jet to rise up the plate. An understanding of the local structure of the free surface in the early stages of motion is vital in many situations and has been developed in detail by King & Needham (1994). In this work we consider the effects of introducing weak surface tension, characterized by the inverse Weber number, W, into the problem considered by King & Needham (1994). Our approach is based upon matched asymptotic expansions as W to 0. It is found that four asymptotic regions are needed to describe the problem. The three largest regions have analytical solutions whilst a numerical method based on finite differences is used to solve the time dependent harmonic boundary value problem in the last region. We also present some preliminary comparisons between experiments and theory.

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