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Boundary Integral Method for the Solution of Viscous Flow over Topography ALI MAZOUCHI, Department of Mechanical Engineering,Stanford University, GEORGE M. HOMSY, Department of Chemical Engineering, Stanford University — We study viscous flow over topographical features under the action of an external body force. The 2-D Navier-Stokes equations are written as a set of harmonic and biharmonic equations for vorticity and stream function. A direct biharmonic boundary integral equation method is used to transform these equations to a pair of integral equations on the boundary of the domain. The domain with a pre-assumed free surface profile is discretized and the integral equations are solved numerically to obtain distributions of vorticity and stream function on the boundary. The normal stress condition results in a nonlinear third order differential equation for the interface position, which is solved using an iteration technique to update the location of the free boundary. We have studied the flow over steps and trenches with different depths. Our computation shows that the free-surface develops a ridge before the entrance of a trench and this ridge can become large for larger depths. Our results are compared with those obtained using lubrication theory.