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Existence and uniqueness of the solution of a supercritical free surface flow problem over an obstacle

In this work, we use the implicit function theorem on Banach spaces to prove the existence and uniqueness of the solution of a supercritical, irrotational, bidimensional and stationary free surface flow over an obstacle. Considering gravity and neglecting surface tension, we find the equilibrium free surface of the flow of an inviscid and incompressible fluid in a wide Channel which is perturbed by an obstacle at its bottom. Moreover, the Banach spaces chosen ensure the asymptotic behavior.