

Instability of shallow-water shock waves with application to a circular hydraulic jump

Aslan Kasimov

King Abdullah University of Science and Technology Saudi Arabia

We investigate instability of shallow-water shock waves within the framework of Whitham's geometric shock dynamics. The analysis is carried out for a particular case of a circular hydraulic jump that forms when a vertical jet of viscous fluid strikes a horizontal plate. We derive a third order nonlinear partial differential equation for the shock-shape evolution and show that the equation predicts instability. We analyze the instability as a function of various parameters in the problem. In particular we show that the instability depends only on two dimensionless groups, the Bond number and the Froude number, both defined in terms of the flow conditions immediately ahead of the stationary circular jump.