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Effect of viscosity on undular bores

R. Grimshaw

University of Loughborough

In inviscid nonlinear wave evolution equations, such as the Korteweg-de Vries equation, unsteady undular bores can be modelled using the Whitham theory of modulated periodic waves. Here we consider the effect of viscosity on this asymptotic theory. Using the integrable Kaup-Boussinesq system, modified by viscosity, we adapt the Whitham modulation theory to take account of viscosity. When the viscosity takes the familiar Burgers form, we are able to reconcile the classical Benjamin-Lighthill theory of steady undular bores with the Whitham modulation theory.