Seminario de Análisis Numérico de Ecuaciones Diferenciales Parciales.

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Numerical Methods for some dispersive water wave equations

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Resumen

We study some finite difference schemes for a Benney-Lin equation type perturbed by a dispersive and dissipative terms

$$u_t + \eta\, u_{xxxxx} + \beta\, u_{xxxx} + u_{xxx} + \gamma\, u_{xx} + u\, u_x = 0, \quad x \in \mathbb{R}, \quad t > 0,$$
$$u(x,\, 0) = u_0(x),$$

BenneyLin equation ($\beta = \gamma$) describes the evolution of long waves in various problems in fluid dynamics. In purely dispersive form ($\beta = \gamma = 0$), this equation reduces to the Kawahara equation (or the fifth-order Kortewegde Vries equation) that describes the water waves with surface tension. In the purely dissipative form, it reduces to the longwave simplification of the NavierStokes equation. The dissipative-dispersive equation ($\eta = 0$ and $\beta = \gamma$) is a generalized KuramotoSivashinsky-KdV equation that describes the waves in the vertical and inclined falling film, in liquid films that are subjected to interfacial stress from adjacent gas low, interfacial instability between two cocurrent viscous fluids, unstable drift waves in plasma, and phase evolution for the complex GinzburgLandau equation.