Numerical Investigation of Boussinesq Equations with Saturation

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We consider Boussinesq type equations with saturated nonlinearity. The Proper Boussinesq equation with saturated nonlinearity (BPES) in one space dimension is of the form $u_{tt} = [u - \frac{u^2}{1+\gamma u^2} - u_{xx}]_{xx}$ and the analogous Paradigm Boussinesq equation is of the form $u_{tt} = [u - \frac{u^2}{1+\gamma u^2} - u_{xx} + u_{tt}]_{xx}$.

To investigate these kind of problems we use a combination of Christov- Galerkin method and finite differences numerical schemes by introducing an auxiliary function $q = \frac{u^2}{1+\gamma u^2}$ to get $u_{tt} = [u - q - u_{xx}]_{xx}$. We solve the stationary problem and use its solution as initial condition for the time dependent problem. We use different values of the saturation parameter and investigate its impact in the total phase speed of the system. We examine thoroughly the phase shift of the solitons upon collision and evaluate numerically the mass and energy of the system and prove that the numerical scheme preserves the conservative properties.

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