A numerical and analytical studies of solitary-wave solution for the Extended Benjamin-Bona-Mahony equation

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ABSTRACT

The Regularized Long-Wave equation (RLW-equation), also known as the BBM-equation $u_t + u_x + (u^2)_x - u_{xxt} = 0$, was first studied as a model for small-amplitude long waves that propagate on the free surface of a perfect fluid [1]. As an alternative to the Korteweg-de Vries equation, it features a balance between nonlinear $(u^2)_x$ and frequency dispersive terms $-u_{xxt}$ that allow existence of traveling waves that are smooth and symmetric about their maximum. Such waves decay rapidly to zero on their outskirts and, because of their nature to travel alone, are known as solitary waves.

We are interested here in solitary-wave solutions of the equation

$$u_t + \alpha u_x + \beta_p(u^p)_x + \beta_q(u^q)_x - \gamma u_{xxt} = 0,$$

which we named the EGRLW-equation (Extended Generalized Regularized Long Wave-equation). We are investigating change of stability of such solutions for different powers p and q, as well as various values of the coefficients α, β_p, β_q and γ. Presented here are numerical simulations of evolution of solitary waves, the behavior of solitary waves under perturbation as well as interaction of two solitary waves and resolution of the initial disturbances into solitary waves.

References

[1] T.B. Benjamin, J.L. Bona and J.J. Mahony Model equations for long waves in nonlinear dispersive systems, *Philos. Trans. Royal Soc. London Ser. A*, **272** (2007.07.17)