Structure-preserving numerical integrators for peakon b-family equations

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Abstract:

In this talk, we study the numerical methods for Degasperis–Procesi (DP) equation with two kind of solutions: peakon solution and shock peakon solution. As an integrable system, the DP equation has the bi-Hamiltonian structure. Based on the Hamiltonian formulation, we simulate the peakon solution by combining the symplectic method in time and Fourier pseudospectral method in space. Though the DP equation and the Camassa–Holm (CH) equation both belong to a family of dispersive nonlinear equations, they have the different physical nature: the DP equation has the shock peakon solution while the CH equation does not have. As the solution has the discontinuous property, we use the operator splitting technique presented by Feng and Liu (2009) in [1] to decompose the DP equation as two subsystems: Burgers' equation and the BBM equation. The resulting numerical discretization is derived by applying the WENO scheme of order 5, Euler mid-point rule in space and the corresponding structure-preserving method in time. The numerical comparison of the new derived method and the numerical method constructed in [1] is also provided.

References:

1. B. Feng and Y. Liu. An operator splitting method for the Degasperis-Procesi equation. J. Comput. Phys., 228:7805–7820, 2009.