Seminar Announcement

Speaker: **Ayhan Aydın**
(joint work with Sevim Ertuğ)

(Atılım University)

Energy conservation for the 3-coupled nonlinear Schrödinger equation by using the Average Vector Field method

The N-coupled nonlinear Schrödinger (N-CNLS) equation arises as the governing model equation in several branches of physics including, for example, optics, fluid dynamics, quantum mechanics and biophysics (cf. [1-3] and references therein). In the last decades, there has been an increased interest in numerical preservation of one or more physical/geometric properties of the mechanical system under consideration [4, 5]. In this study, we construct an energy conserving numerical scheme for the 3-CNLS equation by using the AVF method [6, 7]. Many numerical results are carried out to test the efficiency and reliability of the proposed scheme for the 3-CNLS equation. The numerical results show that the proposed energy conserving scheme has an excellent performance in simulating the plane wave, periodic, single and colliding soliton solutions of the 3-CNLS equation during long-time integration. The ability of capturing low- and high-frequency waves is examined for the proposed scheme. Moreover, the scheme preserves the other invariants of the 3-CNLS equation as well as the discrete energy of the system.

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References:

[1] C.C. Mei, The Applied Dynamics of Ocean Waves, World Scientific, Singapore, 1989.
[2] Y.S. Kivshar, G.p. Agrawal, Optical Solutions, Academic Press, San Diego, USA, 2003.
[3] A. Aydin, "Multisymplectic integration of N-coupled nonlinear Schrödinger equation with destabilized periyodic wave solutions, Chaos, Solitons & Fractals, 41(2009), 735-751.
[4] E. Hairer, C. Lubich and G. Wanner, "Geomeric Numerical Integration Structure-Preserving Algorithms for Ordinary Differential Equations", 2nd Ed. Springer, Vol.31, New York, 2005.
[5] B. Leimkuhler and S. Reich, "Simulating Hamiltonian Dynamics", Cambridge University Press, Cambridge, England, 2004.
[6] R.I. McLachlan, G.R.W. Quispel, N. Robidoux, "Geometric integration using discrete gradients", Phil. Trans. Roy. Soc. A, 357(1999), 1021-1046.
[7] E. Celledoni, V. Grimm, R.I. McLachlan, D.I. McLaren, D. O'Neale, B. Owren, G.R.W. Quispel, "Preserving energy resp. dissipation in numerical PDEs using the "Average Vector Field" method", J. of Computational Physics, 231(2012), 6770-6789.

All interested people are cordially invited.
After the seminar, some cookies and soft drinks will be served.

DATE: February 25, 2015
TIME: 15:45
PLACE: FEF 404 (Seminar Room)