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Vasily Yu Belashov

Kazan Federal University, Russia

Dynamics of multidimensional nonlinear wave structures of the soliton and vortex types in dispersive complex media: Theory, simulation and applications

This paper is devoted to a one of the most interesting and rapidly developing areas of modern nonlinear physics and mathematics i.e. the theoretical, analytical and advanced numerical study of the structure and dynamics of two- and three-dimensional solitons and nonlinear waves described by Kadomtsev-Petviashvili, derivative nonlinear Schrodinger classes of equations and also the vortex systems described by Euler-type equations. Special attention is paid to generalizations (relevant to various complex physical media) of these equations, accounting for high-order dispersion corrections, influence of dissipation, instabilities, and stochastic fluctuations of the wave fields. This is consistent representation of the both early known and new original results obtained by author and also some generalizations in theory and numerical simulation of the nonlinear waves, solitons and vortex dynamics in dispersive media. On a level with detail consideration of pure theoretical aspects, special attention is paid to the applications of the theory in different fields of modern physics including plasma physics (such as 2D and 3D ion-acoustic, fast magnetosonic and Alfvén nonlinear wave structures and vortex dynamics), hydrodynamics (evolution of 2D nonlinear waves on shallow water with depth varying in space and time) and physics of the upper atmosphere (transformation of 2D internal gravity waves and traveling ionospheric disturbances in regions with sharp gradients of the parameters of medium).

Biography

Vasily Yu Belashov has done his PhD (Radiophysics) and Doctor of Science (Physics and Mathematics). His main fields of research are: Theory and numerical simulation of the dynamics of multi-dimensional nonlinear waves, solitons and vortex structures in plasmas and other dispersive media. Currently, he is a Professor at the Kazan Federal University. He was the Coordinator of Studies for the International Program "Solar Terminator" (1987-1992), and took part in Programs WITS/WAGS and STEP. He is author of 288 publications and one book "Solitary Waves in Dispersive Complex Media".

vybelashov@yahoo.com