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**Adaptive Fourier Bessel and Wavelet transform methods for tracking optical pulses in (D+1)-dimensions** GEORGES NEHMETALLAH, PARTHA BANERJEE, University of Dayton — Traditional numerical techniques such as finite-difference, function approximation and pseudo-spectral methods are used to solve the NLS equation, which models pulse, beam or optical bullet propagation in fiber and unbounded media respectively. However, in all the above techniques tracking the solution is either time consuming or inaccurate because the problem in hand might be (D+1) dimensional. In this work we present two novel techniques which we call adaptive Fourier Bessel split-step (ASFBSS) and adaptive wavelet transform (AWT) methods, to numerically solve (D+1) optical pulse propagation in fiber and bulk Kerr type nonlinear media based on the scalar nonlinear Schrödinger (NLS) equation in (D+1) dimensions with cylindrical or spherical symmetry in 2 and 3 dimensions respectively. Using fast algorithms for cylindrical/spherical Fourier Bessel or wavelet transforms along with adaptive longitudinal stepping and transverse grid management in a symmetrized split-step technique, it is possible to accurately study many nonlinear effects, including the possibility of self-focusing, self-steepening, spatio-temporal collapse, collapse-arresting mechanism due to saturable non-linearity or beam nonparaxiality, variable Kerr nonlinearity, and variable dispersion managed systems.

Georges Nehmetallah
University of Dayton

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