

Abstract:

A perturbation theory for the Short Pulse Equation is developed to investigate the effects of various perturbations to optical solitons propagating in nonlinear media in the few femtosecond regime. Because linear analysis about the exact solution is not possible, the theory is formulated using a variational approach. A variety of physically realizable perturbations are considered, especially those which result from short-pulse mode-locking. In each case, the analytic results are in agreement with full numerical simulations of the short-pulse theory. Given the success of soliton perturbation theory as applied optical solitons, this analysis attempts to provide the same theoretical framework for understanding physically realizable mechanisms that affect pulse evolution and stability when slow envelope approximation is no longer a realistic assumption.