Interplay between disorder and nonlinearity in the propagation of waves in one-dimensional nonlinear random media: Fixed input case

Ba Phi Nguyen[1], Hanjo Lim[2], and Kihong Kim[1,*]

[1]Division of Energy Systems Research, Ajou University, Suwon, 443-749, Korea
[2]Department of Electrical Engineering, Ajou University, Suwon, 443-749, Korea
[*]Tel: 82-31-219-2584, email: khkim@ajou.ac.kr

Abstract:

The tight-binding Anderson model including the nonlinear effect is used to study the interplay between diagonal disorder and nonlinearity in the propagation of waves in one-dimensional random media for a fixed input problem. The system is described by the time-independent discrete nonlinear Schrödinger equation. We solve this equation in a numerically exact manner for a given random potential and obtain physical quantities by averaging over a large number of disorder configurations. We find substantial differences between our results and previous results obtained for the fixed output case. The Anderson localization is found to be enhanced by both focusing and defocusing nonlinearities and contrary to the fixed output case, the power law decay of the average transmittance is not observed. We also show that the dependence of the localization length on disorder changes as the energy is changed from the band edge value toward the band center value.