Optical Solitons in $\mathcal{PT}$ Symmetric Lattice with Defect

Nalan Antar
Istanbul Technical University, Department of Mathematics, Maslak 34469, Istanbul, Turkey
email: antarn@itu.edu.tr

Abstract:

The propagation of light beams along the z- axis of the medium composed from alternating domains with cubic and saturable nonlinearities is described by nonlinear Schrödinger equation (NLSE) with the external potential

$$i\frac{\partial u}{\partial z}+\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{|u|^2 u}{1+s|u|^2}+V(x,y)u=0$$

Saturation paramater $s=0$ and $s=1$ correspond to the cubic domain and the saturable domain respectively. In this talk, I will discuss the existence of optical solitons supported by cubic-saturable nonlinerarity , in the framework of nonlinear Schrödinger equation with PT symmetric lattice with defect by using the pseudo-spectral renormalization method. The idea behind the spectral renormalization method is to transform the governing equation into Fourier space and find a nonlinear nonlocal integral equation coupled to an algebraic equation and determine a convergence factor based upon the degree (homogeneity) of a single nonlinear term. The convergence factor can not found explicitly from the governing equation for saturable case by the use of the spectral renormalization method . In order to find the convergence factor, the root finding code has to be used such as the Newton method but if we use the pseudo-spectral renormalization method the convergence parameter is found from the governing equation explicitly. The pseudo-specral renormalization method can efficiently be applied to a large class of problems including higher order nonlinear terms with different homogeneities. In first part of my talk, I will present the pseudo-spectral renormalization method for cubic-saturable nonlinearity. In the second part of my talk, I will investigate the existence and stability of the optical solitons in parity-time $\mathcal{PT}$ symmetric lattice with defect in focusing cubic-saturable media.