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Localized standing waves in inhomogeneous Schrodinger equations

R. Marangell, C.K.R.T. Jones, H. Susanto

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A nonlinear Schrodinger equation arising from light propagation down an inhomogeneous medium is considered. The inhomogeneity is reflected through a non-uniform coefficient of the non-linear term in the equation. In particular, a combination of self-focusing and self-defocusing nonlinearity, with the self-defocusing region localized in a finite interval, is investigated. Using numerical computations, the extension of linear eigenmodes of the corresponding linearized system into nonlinear states is established, particularly nonlinear continuations of the fundamental state and the first excited state. The (in)stability of the states is also numerically calculated, from which it is obtained that symmetric nonlinear solutions become unstable beyond a critical threshold norm. Instability of the symmetric states is then investigated analytically through the application of a topological argument. Determination of instability of positive symmetric states is reduced to simple geometric properties of the composite phase plane orbit of the standing wave. Further the topological argument is applied to higher excited states and instability is again reduced to straightforward geometric calculations. For a relatively high norm, it is observed that asymmetric states bifurcate from the symmetric ones. The stability and instability of asymmetric states is also considered.

Comments:	Suggestions and comments are welcome
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