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Regularization of spectral singularities in a PT-symmetric system with saturable nonlinearities XUELE LIU, University of Texas, Dallas, SUBHASISH DUTTA GUPTA, University of Hyderabad, Hyderabad, India, GIRISH AGARWAL, Oklahoma State University — Spectral response of a linear PT-symmetric system is known to lead to singularities leading to infinite transmission and reflection coefficients. Near such spectral singularities (because of the infinite growth of the amplitudes) the assumption of linearity of the system breaks down, and it is necessary to incorporate a nonlinear mechanism, which could saturate the growth of the scattering amplitudes. We show that an all-order nonlinearity, such as a saturable nonlinearity, can indeed limit the infinities associated with the linear PT-symmetric systems. In the example of a quasi-one dimensional wave-guide with equal loss and gain segments, we demonstrate this regularisation. Our numerical simulation is based on the exact Helmholtz equation with the saturable gain and loss. We further present explicit numerical results to demonstrate optical diode action, whereby, light is allowed to pass only in one preferential direction, and it is blocked for the other direction. The switching and near-perfect isolation of the PT-symmetric device can find many applications in optical signal processing and chip-level integration.

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