# Stability analysis for pitchfork bifurcations of solitary waves in generalized nonlinear Schroedinger equations

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Linear stability of both sign-definite (positive) and sign-indefinite solitary waves near pitchfork bifurcations is analyzed for the generalized nonlinear Schroedinger equations with arbitrary forms of nonlinearity and external potentials in arbitrary spatial dimensions. Bifurcations of linear-stability eigenvalues associated with pitchfork bifurcations are analytically calculated. It is shown that the smooth solution branch switches stability at the bifurcation point. In addition, the two bifurcated solution branches and the smooth branch have the opposite (same) stability when their power slopes have the same (opposite) sign. One unusual feature on the stability of these pitchfork bifurcations is that the smooth and bifurcated solution branches can be both stable or both unstable, which contrasts such bifurcations in finite-dimensional dynamical systems where the smooth and bifurcated branches generally have opposite stability. For the special case of positive solitary waves, stronger and more explicit stability results are also obtained. It is shown that for positive solitary waves, their linear stability near a bifurcation point can be read off directly from their power diagram. Lastly, various numerical examples are presented, and the numerical results confirm the analytical predictions both qualitatively and quantitatively.

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