

Double-pole soliton solution for the derivative nonlinear Schrödinger equation with nonvanishing boundary conditions

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Abstract:

The derivative nonlinear Schrödinger equation is an integrable extension for the ubiquitous nonlinear Schrödinger equation with inclusion of the nonlinear dispersion, also describing nonlinear waves in many fields of classical and quantum physics. We find the equation possesses multiple poles under nonvanishing boundary conditions and find a double-pole soliton solution for it. The solution is a weakly bound state of a bright soliton and a dark soliton and, unlike those found in scalar equations with vanishing boundary conditions[1-5], is not limits of its simple-pole solitons[6-7] when merging distinct simple poles.

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