Integrable nonlinear Schrödinger system on an intercalated ladder lattice

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The dynamical nonlinear system of coherently coupled excitations on a lattice with three structural elements in the unit cell is suggested. Its integrability in the Lax sense is proved in the framework of a certain generalized semi-discrete zero-curvature representation permitting a number of particular reductions. The system is characterized by the six basic field variables and four concomitant ones. Due to the nonzero background values of concomitant fields, the set of inter-site resonant coupling parameters turns out to be substantially extended introducing three additional (background-controlled) types of inter-site resonant interactions. The arrangement of inter-site resonant bonds between the spatial sites of basic excitations supports the ladder-like structure of underlying lattice intercalated by the intermediate row of mutually uncoupled sites. By virtue of integrability the complexity of system dynamics can be incorporated into the properly developed dressing procedure based on the Darboux transformation for the auxiliary linear problem accompanied by the implicit Bäcklund transformation of field variables. The successive application of this procedure allows to generate recursively the system soliton solutions starting with the trivial (vacuum) one. The multi-component soliton solution is presented explicitly and the implications of key parameters in soliton dynamics are explained. Remarkably, that the arbitrariness in time dependencies of system coupling parameters allows to model a wide variety of external parametric drivings applicable to the system without the loss of its integrability.

1. O.O. Vakhnenko. Integrable nonlinear Schrödinger system on a lattice with three structural elements in the unit cell. *J. Math. Phys.* **59**(5), 053504 (25 pages) (2018).
2. O.O. Vakhnenko. Nonlinear integrable system of coherently coupled excitations on an intercalated ladder lattice. *Eur. Phys. J. Plus* **133**(6), 243 (19 pages) (2018).