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Development and analysis of novel integrable nonlinear dynamical systems on quasi-one-dimensional lattices. Parametrically driven nonlinear system of pseudo-excitations on a two-leg ladder lattice

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Following the main principles of developing the evolutionary nonlinear integrable systems on quasi-one-dimensional lattices we suggest the novel nonlinear integrable system of parametrically driven pseudo-excitations on a regular two-leg ladder lattice. The initial (prototype) form of the system is derivable in the framework of semi-discrete zero-curvature equation with the spectral and evolution operators specified by the properly organized 3×3 square matrices. Although the lowest conserved local densities found via the direct recursive method do not prompt us the algebraic structure of system's Hamiltonian function, but the heuristically substantiated search for the suitable two-stage transformation of prototype field functions to the physically motivated ones has allowed to disclose the physically meaningful nonlinear integrable system with time-dependent longitudinal and transverse inter-site coupling parameters. The time dependencies of inter-site coupling parameters in the transformed system are consistently dened in terms of the accompanying parametric driver formalized by the set of four homogeneous ordinary linear dierential equations with the time-dependent coeficients. The physically meaningful parametrically driven nonlinear system permits its concise Hamiltonian formulation with the two pairs of field functions serving as the two pairs of canonically conjugated field amplitudes. The explicit example of oscillatory parametric drive is described in full mathematical details.

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