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Oscillator realisations associated to the $D$-type Yangian: towards the operatorial Q-system of orthogonal spin chains. (English)


Summary: We present a family of novel Lax operators corresponding to representations of the RTT-realisation of the Yangian associated with $D$-type Lie algebras. These Lax operators are of oscillator type, i.e. one space of the operators is infinite-dimensional while the other is in the first fundamental representation of $\mathfrak{so}(2r)$. We use the isomorphism between the first fundamental representation of $D_r$ and the 6 of $A_3$, for which the degenerate oscillator type Lax matrices are known, to derive the Lax operators for $r = 3$. The results are used to generalise the Lax matrices to arbitrary rank for representations corresponding to the extremal nodes of the simply laced Dynkin diagram of $D_r$. The multiplicity of independent solutions at each extremal node is given by the dimension of the fundamental representation. We further derive certain factorisation formulas among these solutions and build transfer matrices with oscillators in the auxiliary space from the introduced degenerate Lax matrices. Finally, we provide some evidence that the constructed transfer matrices are Baxter Q-operators for $\mathfrak{so}(2r)$ spin chains by verifying certain QQ-relations for $D_4$ at low lengths.

MSC:
82B20 Lattice systems (Ising, dimer, Potts, etc.) and systems on graphs arising in equilibrium statistical mechanics

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