

# Rational spin chains at higher rank: new tools to solve, completeness, and separation of variables

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We present recent advances in solution of rational spin chains that build on results from representation theory of Yangian and analytic Bethe Ansatz. First we show how to find spectrum of supersymmetric  $GL(N|M)$  chains using  $Q$ -system on Young diagrams. This approach can be more efficient than conventional nested Bethe equations, and also it provides one with means for explicitly counting solutions and hence for proving completeness. Second, we discuss the separation of variables program for  $GL(N)$  chains with generic twist and inhomogeneities and, notably, in arbitrary finite-dimensional representation. For them, we present an SoV basis in which eigenstates are products of Slater determinants of Baxter  $Q$ -functions and discuss its connection to Gelfand-Tsetlin patterns and to generalisations of Sklyanin B-operator.

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