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Bart Vlaar
(Beijing Institute for Mathematical Sciences and Applications)

The origin of trigonometric K-matrices

Quantum integrability can be characterized by an R-matrix (a solution of the Yang-Baxter equation). Drinfeld observed that the universal R-matrix of a quantum affine algebra acts on tensor products of finite-dimensional representations of the corresponding quantum loop algebra. It results in a matrix-valued formal series R(z) in the multiplicative spectral parameter z. If the representations are irreducible, R(z) depends essentially rationally on z, so trigonometrically on log(z).

For quantum integrable systems with boundaries (e.g. open spin chains) K-matrices, solutions of the reflection equation (boundary YBE), have been studied since the 1980s (Cherednik, Sklyanin, Kulish & Sklyanin, Mezincescu & Nepomechie, etc.). In recent joint work with A. Appel we prove the existence of a universal K-matrix and use it in a boundary analogue of Drinfeld's approach. In addition to a quantum affine algebra one must specify a suitable subalgebra (to be viewed as an algebra of residual symmetries, i.e. those compatible with the boundary).

It guarantees a "limitless supply" of trigonometric K-matrices: for each finite-dimensional representation there is a matrix-valued formal Laurent series K(z), satisfying a generalized reflection equation considered by Cherednik in 1992. Again, if the representation is irreducible, K(z) depends essentially rationally on z.