Algebraic properties of Manin matrices II: q-analogues and integrable systems

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Résumé en anglais: We study a natural q-analogue of a class of matrices with non-commutative entries, which were first considered by Yu.I. Manin in 1988 in relation with quantum group theory, (called Manin matrices in [5]). We call these q-analogues q-Manin matrices. These matrices are defined, in the 2×2 case by the following relations among their matrix entries:

\[ M_{21} M_{12} = q M_{12} M_{21}, \quad M_{22} M_{12} = q M_{12} M_{22} \]

They were already considered in the literature, especially in connection with the q-MacMahon master theorem [10], and the q-Sylvester identities [22]. The main aim of the present paper is to give a full list and detailed proofs of the algebraic properties of q-Manin matrices known up to the moment and, in particular, to show that most of the basic theorems of linear algebras (e.g., Jacobi ratio theorems, Schur complement, the Cayley–Hamilton theorem and so on and so forth) have a straightforward counterpart for such a class of matrices. We also show how q-Manin matrices fit within the theory of quasideterminants of Gelfand–Retakh and collaborators (see, e.g., [11]). We frame our definitions within the tensorial approach to non-commutative matrices of the Leningrad school in the last sections. We finally discuss how the notion of q-Manin matrix is related to theory of Quantum Integrable Systems.
Liens
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