

# On the Lagrangian structure of integrable quad-equations

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The new idea of flip invariance of action functionals in multidimensional lattices was recently highlighted as a key feature of discrete integrable systems. Flip invariance was proved for several particular cases of integrable quad-equations by Bazhanov, Mangazeev and Sergeev and by Lobb and Nijhoff. We provide a simple and case-independent proof for all integrable quad-equations. Moreover, we find a new relation for Lagrangians within one elementary quadrilateral which seems to be a fundamental building block of the various versions of flip invariance.

Subjects: **Exactly Solvable and Integrable Systems (nlin.SI)**; Mathematical Physics (math-ph)

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