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Nonlinear Sciences > Exactly Solvable and Integrable Systems

Multi-quadratic quad equations: integrable cases from a factorised-discriminant hypothesis

James Atkinson, Maciej Nieszporski

(Submitted on 3 Apr 2012)

We give integrable quad equations which are multi-quadratic (degree-two) counterparts of the well-known multi-affine (degree-one) equations classified by Adler, Bobenko and Suris (ABS). These multi-quadratic equations define multi-valued evolution from initial data, but our construction is based on the hypothesis that discriminants of the defining polynomial factorise in a particular way that allows to reformulate the equation as a single-valued system. Such reformulation comes at the cost of introducing auxiliary (edge) variables and augmenting the initial data. Like the multi-affine equations listed by ABS, these new models are consistent in multidimensions. We clarify their relationship with the ABS list by obtaining Backlund transformations connecting all but the primary multi-quadratic model back to equations from the multi-affine class.

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