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Symbolic computation of Lax pairs of nonlinear partial difference equations

Willy Hereman¹ and Reinout Quispel²

¹Department of Mathematical and Computer Sciences
Colorado School of Mines
Golden, CO 80401-1887
USA

`whereman@mines.edu`

²Department of Mathematical and Statistical Sciences
LaTrobe University
Bundoora, Victoria 3083
AUSTRALIA

`r.quispel@latrobe.edu.au`

Abstract

A partial difference equation ($P\Delta E$) is a fully discretized version of a PDE. Nijhoff and collaborators have established a method to derive Lax pairs for so-called integrable $P\Delta Es$. Their method is largely algorithmic and can be implemented in the syntax of computer algebra systems, such as Mathematica and Maple.

A Mathematica program will be presented that automatically computes Lax pairs for a variety of 2-dimensional $P\Delta Es$, including lattice versions of the (potential) KdV, modified KdV, and sine-Gordon equations, as well as lattices derived by Adler, Bobenko, and Suris.