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Direct reductions of differential-difference equations

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Abstract

We consider integrable differential-difference equations in two dimensions, governing $u \in \mathbb{R}$ dependent on two variables $(n, t) \in \mathbb{R}^2$ where derivatives with respect to t and iterates in n appear, and find new reductions of such equations to ordinary differential-difference equations (sometimes called delay equations) involving one independent variable $\eta \in \mathbb{R}$. The latter equations govern $H(\eta)$ where derivatives and iterates in the same variable η appear. These reductions are found by a direct method that has not been applied to differential-difference equations before.