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Prolongation Structure and Integrability of the coupled KdV-mKdV system

Recently, Kersten and Krasil'shchik constructed the recursion operator for a coupled KdV-mKdV system, which arises as the classical part of one of superextensions of the KdV equation. In this work, we study the integrability of this system using the Painlevé test. Then, we use the Dodd–Fordy algorithm for the Wahlquist–Estabrook prolongation technique in order to obtain the Lax pair. We find a 3×3 matrix spectral problem for the Kersten and Krasil'shchik system. We also show that the Lax pair obtained is a true Lax pair since the spectral parameter cannot be removed by a gauge transformation, as can be proven by a gauge-invariant technique.

This is a joint work with Ayse Karasu and Sergei Yu. Sakovich.