

The Modified Korteweg-de Vries Hierarchy: Lax Pair Representation and Bi-Hamiltonian Structure

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We consider equations in the modified Korteweg-de Vries (mKdV) hierarchy and make use of the Miura transformation to construct expressions for their Lax pair. We derive a Lagrangian-based approach to study the bi-Hamiltonian structure of the mKdV equations. We also show that the complex modified KdV (cmKdV) equation follows from the action principle to have a Lagrangian representation. This representation not only provides a basis to write the cmKdV equation in the canonical form endowed with an appropriate Poisson structure but also help to construct a semianalytical solution of it. The solution obtained by us may serve as a useful guide for purely numerical routines which are currently being used to solve the cmKdV equation.

Key words: Real and Complex Modified KdV Equations; Lax Pair Representation; Hamiltonian Structure; Ritz Optimization Procedure; Solitary Wave Solution.

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