

Recursion operators and bi-Hamiltonian representation of the general heavenly equation

Mikhail Sheftel

Bogazici University
34342 Bebek
Istanbul, Turkey

Joint work with: A.A. Malykh, D. Yazici

Recursion operators and bi-Hamiltonian structure of the general heavenly equation We discover two additional Lax pairs and three nonlocal recursion operators for symmetries of the general heavenly equation introduced by Dubrov and Ferapontov. Converting the equation to a two-component form, we obtain Lagrangian and Hamiltonian structures of the two-component general heavenly system. We study all point symmetries of the two-component system and, using the inverse Noether theorem in the Hamiltonian form, obtain all the integrals of motion corresponding to each variational (Noether) point symmetry. We discover that all the recursion operators coincide in the two-component form. Applying the recursion operator to the first Hamiltonian structure we obtain second Hamiltonian structure. We prove the Jacobi identities for the second Hamiltonian operator and compatibility of the two Hamiltonian structures. Thus, we demonstrate that the general heavenly equation in the two-component form is a bi-Hamiltonian system integrable in the sense of Magri. We demonstrate how to obtain nonlocal Hamiltonian flows generated by local Hamiltonians by using Hermitian conjugate recursion operator.