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NON-NOETHER SYMMETRIES IN HAMILTONIAN SYSTEMS

We discuss some geometric aspects of the concept of non-Noether symmetry. It is shown that in regular Hamiltonian systems such a symmetry canonically leads to a Lax pair on the algebra of linear operators on cotangent bundle over the phase space. Correspondence between the non-Noether symmetries and other wide spread geometric methods of generating conservation laws such as bi-Hamiltonian formalism, bidifferential calculi and Frölicher–Nijenhuis geometry is considered. It is proved that the integrals of motion associated with the continuous non-Noether symmetry are in involution whenever the generator of the symmetry satisfies a certain Yang–Baxter type equation. Non-Noether symmetries of the Toda model, nonlinear Schödinger equation and Korteweg-de Vries equations (KdV and mKdV) are discussed. It appears that these symmetries yield the complete sets of conservation laws in involution and lead to the bi-Hamiltonian realizations of the above mentioned models.