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Klein geometry and bi-Hamiltonian structure of soliton equations

From the viewpoint of classical mechanics, a distinguishing feature of soliton equations is that they possess two compatible Hamiltonian formulations. In the case of the sine-Gordon (SG) equation, modified Korteweg–de Vries (mKdV) equation, and nonlinear Schrodinger (NLS) equation, it is known that their bi-Hamiltonian structure has a remarkable geometric origin connected with the classical frame structure equations for curve motions in S^2, R^2, and R^3, respectively. In this talk I will describe a broad generalization of these results to the setting of curve motions in Klein geometry, which gives a geometrical derivation of group-invariant (multicomponent) generalizations of mKdV, NLS, and SG soliton equations along with their bi-Hamiltonian structure, symmetries, and conservation laws.