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Hamilton–Jacobi theory in Minkowski space via Cartan geometry

A complete solution to the problem of orthogonal separation of variables of the Hamilton–Jacobi equation in three-dimensional Minkowski space is obtained. The solution is based on the underlying ideas of Cartan geometry and ultimately developed into a general new algorithm that can be employed in the study of Hamiltonian systems defined by natural Hamiltonians within the framework of Hamilton–Jacobi theory. To demonstrate its effectiveness, we investigate, from this viewpoint, the Morosi–Tondo integrable system derived as a stationary reduction of the seventh-order Korteweg–de Vries flow to show explicitly that the system in question is an orthogonally separable Hamiltonian system. The latter result is a new characterization of the Morosi–Tondo system.

This is joint work with Joshua Horwood and Raymond McLenaghan.