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## *Orthogonal separation of variables, new integrable systems and Nijenhuis geometry*

In XIXth century Jacobi explicitly formulated the following problem: find geodesic flows with potential, for which the Hamilton-Jacobi equation can be solved in quadratures. The natural class of such metrics was very soon found: one assumes that the solution of the Hamilton-Jacobi equation is a sum of functions, each depending on its own coordinate. The problem of description of such metrics was solved in works of Levi-Civita, Stackel, Eisenhart and many other. Thus, the method of orthogonal separation of variables was born. It was later generalized and applied to many different problems from mathematical physics, classical and quantum mechanics, theory of integrable systems.

The rapid development of Nijenhuis geometry led to the discovery of deep relation between the symmetries of gl-regular Nijenhuis operators on a manifold and integrable systems on cotangent bundles of the same manifolds. The corresponding systems possess many remarkable properties. In particular, the case of pairwise distinct real eigenvalues corresponds to the separation of variables. In case of Jordan blocks the Hamilton-Jacobi equation is not a sum of functions, but still admits the solution in quadratures. Thus, the new approach and new systems naturally generalize the systems, admitting the separation of variables. Moreover, they augment the classical answer to the Jacobi's question.

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