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Geometrical representation of the multi-dimensional consistency : 1-form case

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A new notion of integrability called the multi-dimensional consistency for the integrable systems with the 1-form structure is captured in the geometrical language both in classical and especially quantum realms. A zero-curvature condition, which implies the multi-dimensional consistency, will be a key relation in context of Hamiltonian operator. Therefore, the existence of the zero-curvature condition directly leads to the path-independent feature in a mapping (which will be expressed in terms of the Wilson line), namely unitary multi-time evolution operators in the Schrödinger picture, introduced to alternatively capture integrability of the systems. Another important result is the formulation of the continuous multi-time propagator. This new type of the propagator exhibits the path-independent feature on the space of time variables. Consequently, a new perspective on summing all possible paths unavoidably arises as not only all possible paths on the space of dependent variables but also on the space of independent variables must be taken into account.

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