

## On Symplectic and Multisymplectic Structures and Their Discrete Versions in Lagrangian Formalism

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**Abstract:** We introduce the Euler-Lagrange cohomology to study the symplectic and multisymplectic structures and their preserving properties in finite and infinite dimensional Lagrangian systems respectively. We also explore their certain difference discrete counterparts in the relevant regularly discretized finite and infinite dimensional Lagrangian systems by means of the difference discrete variational principle with the difference being regarded as an entire geometric object and the noncommutative differential calculus on regular lattice. In order to show that in all these cases the symplectic and multisymplectic preserving properties do not necessarily depend on the relevant Euler-Lagrange equations, the Euler-Lagrange cohomological concepts and content in the configuration space are employed.

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Key words: Euler-Lagrange cohomology, difference discrete variational principle, symplectic structure

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