

SECOND-ORDER LAGRANGIANS ADMITTING A FIRST-ORDER HAMILTONIAN FORMALISM

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ABSTRACT. From the earlier seventies thanks to the works of Goldschmidt and Stenberg (see [1]) and P. L. García (see [2]) among others, jet bundles constitute the natural geometric setting to develop the Lagrangian and Hamiltonian formalisms in the calculus of variations on fibred manifolds, as well as to study the presymplectic structure attached to a variational problem. As is known, classical fields can be viewed as the sections of fibred manifolds and the Lagrangian formalism are then formulated in terms of jet manifolds.

In this setting, we study a class of second-order Lagrangian densities admitting a first-order Hamiltonian formalism (see [3]); namely, (1) for each second-order Lagrangian density on an arbitrary fibred manifold $p: E \rightarrow N$ the Poincaré–Cartan form of which is projectable onto J^1E , by using a new notion of regularity previously introduced, a first-order Hamiltonian formalism is developed for such a class of variational problems; (2) the existence of first-order equivalent Lagrangians is discussed from a local point of view as well as global; (3) this formalism is then applied to classical Hilbert–Einstein Lagrangian and a generalization of the BF theory. The results suggest that the class of problems discussed here constitutes a natural variational setting for General Relativity.

REFERENCES

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