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Hamiltonian perturbative approach for high order theories

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Abstract content

Summary

We propose a perturbative method to deal with high order time derivative theories. Following the perturbative Lagrangian approach of Cheng, et al, we develop in this paper the Hamiltonian formulation. In this way is very natural to consider Hamiltonian theories with constraints and in consequence we extend the previous formulations to gauge field theories. The main task of the procedure (whether in Lagrangian or Hamiltonian schemes), is to rewrite the high order degrees of freedom in terms of the first order dynamical variables using the equations of motion. The high order parameters appear as corrections to the effective theory's parameters. For the case of theories with constraints we have variables that are not independent, so we made the replacement of high order variables only for the independent ones, for the remainder we use the constraints. For such theories we correct the symplectic structure using Dirac's brackets. As an example we work out Pais-Uhlenbeck and reparametrized Pais-Uhlenbeck models. The former illustrates the perturbative procedure and we obtain a particular harmonic oscillator theory. The second one is a theory with parametrization invariance so it has two first class constraints; we apply the method and we find at the end the correspondence between both examples and show up their equivalence.

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