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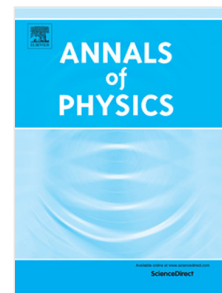
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Applications of Noether conservation theorem to Hamiltonian systems

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Abstract

The Noether theorem connecting symmetries and conservation laws can be applied directly in a Hamiltonian framework without using any intermediate Lagrangian formulation. This requires a careful discussion about the invariance of the boundary conditions under a canonical transformation and this paper proposes to address this issue. Then, the unified treatment of Hamiltonian systems offered by Noether's approach is illustrated on several examples, including classical field theory and quantum dynamics.

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1 Introduction

After its original publication in German in 1918, and even though it was first motivated by theoretical physics issues in General Relativity, it took a surprisingly long time for the physicists of the twentieth century to become aware of the profoundness of Noether's seminal article (see Kosmann-Schwarzbach (2011b) for an English translation and a historical analysis of its impact, see also (Kastrup, 1983, § 7) and Byers (1994)). Since then, about

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