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Periodic solutions of singular Lagrangian systems. (English) Zbl 0785.34032

Progress in Nonlinear Differential Equations and their Applications. 10. Boston, MA: Birkhäuser. xii, 157 p. (1993).

The monograph deals with the existence of periodic solutions of system $\ddot{q} + \mathrm{grad}_q V(t, q) = 0$, where V is a singular potential, i.e. a real valued function, defined on an open unlimited subset $\Omega \subset \mathbb{R}^n$, such that V diverges as q approaches the boundary $\partial\Omega$ of Ω. On the whole there is considered the case when $\Omega = \mathbb{R}^n \setminus \{0\}$. V is assumed periodical with respect to t. Several physical problems are governed by Lagrangians which are not regular. The major purpose of the monograph is to present methods and tools which have been used in research of this topic, that is still in evolution. The offered approach is more on the lines of nonlinear functional analysis. There is given a functional frame for systems with singular potential, including the Kepler and the N- body problems as particular cases. There is used critical point theory to obtain existence results for broad classes of potentials. However the variational methods, which have been employed to obtain important advances in the study of regular Hamiltonian systems, can be succesfully used to handle singular potentials as well.

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MSC:

34C25	Periodic solutions to ordinary differential equations
70H03	Lagrange's equations
37J99	Dynamical aspects of finite-dimensional Hamiltonian and Lagrangian systems
37G99	Local and nonlocal bifurcation theory for dynamical systems
34-02	Research exposition (monographs, survey articles) pertaining to ordinary differential equations
70-02	Research exposition (monographs, survey articles) pertaining to mechanics of particles and systems

Keywords:

Lagrangian systems; Kepler and the N-body problems; periodic solutions; singular potential; Hamiltonian systems