Bruneau, Laurent; **De Bièvre, Stephan**

A Hamiltonian model for linear friction in a homogeneous medium. (English) Zbl 1073.37079

Commun. Math. Phys. 229, No. 3, 511-542 (2002).

Summary: We introduce and study rigorously a Hamiltonian model of a classical particle moving through a homogeneous dissipative medium at zero temperature in such a way that it experiences an effective linear friction force proportional to its velocity (at small speeds). The medium consists at each point in a space of a vibration field modelling an obstacle with which the particle exchanges energy and momentum in such a way that total energy and momentum are conserved. We show that in the presence of a constant (not too large) external force, the particle reaches an asymptotic velocity proportional to this force. In a potential well, on the other hand, the particle comes exponentially fast to rest in the bottom of the well. The exponential rate is in both cases an explicit function of the model parameters and independent of the potential.

MSC:

37J99	Dynamical aspects of finite-dimensional Hamiltonian and Lagrangian systems
35L70	Second-order nonlinear hyperbolic equations
35R10	Partial functional-differential equations
37K05	Hamiltonian structures, symmetries, variational principles, conservation laws (MSC2010)
37N05	Dynamical systems in classical and celestial mechanics
70F40	Problems involving a system of particles with friction

Full Text: DOI