

Exact Invariants for a Class of Three-Dimensional Time-Dependent Classical Hamiltonians

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Abstract:

An exact invariant is derived for three-dimensional Hamiltonian systems of N particles confined within a general velocity-independent potential. The invariant is found to contain a time-dependent function $f_2(t)$, embodying a solution of a third-order differential equation whose coefficients depend on the explicitly known trajectories of the particle ensemble. Our result is applied to a one-dimensional time-dependent nonlinear oscillator and to a system of Coulomb interacting particles in a time-dependent quadratic external potential.