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Determination of broken KAM surfaces in Hamiltonian systems

ROSCOE WHITE, Princeton University — The destruction of KAM surfaces in a Hamiltonian conservative system is an important topic in nonlinear dynamics, and in particular in the theory of particle orbits in toroidal magnetic confinement systems. In this paper we compare three different methods for the detection of the loss of stability of orbits in the dynamics of charged particles in a toroidal magnetic confinement device in the presence of time dependent magnetic perturbations. Only through resonance can orbits be significantly modified in an integrable conservative dynamical system. Without resonance the trajectories in phase space occupy Kolmogorov Arnold Moser (KAM) surfaces that prohibit diffusion. Often individual perturbations of an integrable system are so small that the system is very far from Chirikov overlap, and thus the destruction of the last KAM surface is not a good paradigm for the examination of diffusive transport. It can be necessary to understand the domains of broken KAM surfaces for each perturbation separarately, and to find the resulting transport due to the action of all modes together. We compare methods of determining the stability of orbits in a Hamiltonian system,the method of phase vector rotation, that of the finite Lyapunov indicator and that of frequency analysis.

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