

Some geometric mechanisms for Arnold diffusion

Rafael de la Llave

Georgia Tech

rafael.delallave@math.gatech.edu

Abstract

We consider the problem whether small perturbations of integrable mechanical systems can have very large effects. It is known that in many cases, the effects of the perturbations average out, but there are exceptional cases (resonances) where the perturbations do accumulate. It is a complicated problem whether this can keep on happening because once the instability accumulates, the system moves out of resonance.

Arnold discovered in 1964 some geometric structures that lead to accumulation in carefully constructed examples. We will present some other geometric structures that lead to the same effect in more general systems and that can be verified in concrete systems. In particular, we will present an application to the restricted 3 body problem. We show that, given some conditions, for all sufficiently small (but non-zero) values of the eccentricity, there are orbits near a Lagrange point that gain a fixed amount of energy. These conditions (amount to the non-vanishing of an integral) are verified numerically.

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