Abstract

Nekhoroshev Theorem for the Toda Lattice with Dirichlet Boundary Conditions †

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Abstract: In this paper, we prove a Nekhoroshev theorem for the Toda lattice with Dirichlet boundary conditions, i.e., fixed ends. The Toda lattice is a special case of a Fermi-Pasta-Ulam (FPU) lattice, and in view of the unexpected recurrence phenomena observed numerically in these chains, it has been conjectured that the theory of perturbed integrable systems could be applied to these lattices, especially since the Toda lattice has been shown to be a completely integrable system. Whereas various results have already been obtained for the periodic lattice, the Dirichlet lattice is more important from the point of view of applications, since the famous numerical experiments have been performed for this type of system. Mathematically, the Dirichlet lattice can be treated by exploiting symmetries of the periodic lattice. Precisely, by considering the phase space of the Dirichlet lattice as an invariant submanifold of the periodic lattice, namely the fixed point set of a certain symmetry of the periodic lattice, the results obtained for the periodic lattice can be used to obtain similar results for the Dirichlet lattice. The Nekhoroshev theorem is a perturbation theory result which does not have the probabilistic character of other results such as those of the KAM theorem.

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