

## **Extension of Poincaré's program for integrability and chaos in Hamiltonian systems**

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**Abstract:** In the last chapter of Poincaré's famous three vols. on celestial mechanics, he outlines a program to establish chaos in dynamical systems by identifying periodic and in particular homoclinic and heteroclinic solutions. The geometric insight and the analytic skill to carry out the program has been a severe restriction until now. On the other hand, useful extensions were produced by applying Shilnikov's bifurcation (Devaney) and normal form methods for Hamiltonian systems. The second method was initiated by Poincaré but can be extended to obtain measures of chaos in a number of cases. We will discuss applications in two- and three- d.o.f. systems, chains of oscillators and PDEs where (hidden) symmetries often play a part.