Justification of C. Simó's fractional iteration method and of the frequency method

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Abstract

Prof. Simó introduced a method to compute quasi-periodic orbits of a map f by constructing a new map g, obtained by 'taking a fractional number of iterations' of f, and seeking a fixed point of g.

A recently developed approach to KAM theory provides a justification of the method in the conservative case. Namely, if the method produces a solution of the invariance equation up to a sufficiently small error, then there is a true quasi-periodic solution nearby, unless the problem considered is degenerate.

Similar arguments apply to the frequency method of Laskar and others. We show that if the computed frequency map is not degenerate, then there is a set of large measure characterised by quasi-periodic orbits with frequencies that are close to the numerically predicted ones.