A Methodology for the NUMERICAL COMPUTATION OF NORMAL FORMS, CENTRE MANIFOLDS AND FIRST INTEGRALS OF HAMILTONIAN SYSTEMS

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ABSTRACT. This paper deals with the effective computation of normal forms, centre manifolds and first integrals in Hamiltonian mechanics. These calculations are very useful since they allow us, among other things, to give explicit estimates on the diffusion time and to compute invariant tori. The approach presented here is based on the algebraic manipulation of formal series with numerical coefficients for them. This, together with a very efficient software implementation, allows big savings in memory and execution time in comparison with the use of commercial algebraic manipulators. The algorithms are discussed together with their C/C++ implementations, and they are applied to some concrete examples from celestial mechanics.