Automatic Differentiation tools in computational Dynamical Systems

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We describe a unified framework for the computation of invariant manifolds and normal forms of vector fields using power series, and evaluate their computational cost when applied to simple models. By simple we mean that the model can be written by using arithmetic operations and elementary functions. In this case, the tools of Automatic Differentiation are the key to produce very efficient algorithms.

We present actual implementations of some of the algorithms, with special emphasis to the computation of the 4D center manifold of a Lagrangian point of the Restricted Three Body Problem.