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9. Ordinary Differential Equations and Dynamical Systems

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Zhiming Zheng, School of Math. Sci., Peking Univ., Beijing, 100871, China; Shilong Ma, Dept. of Computer Sci., Beijing Univ. of Aero. & Astronautics, Beijing 100083, China; Shucheng Ning, Inst. of Math. , Academia Sinica. Beijing 100080, China

On Symbolic Computation of the LCE of N-dimensional Dynamical Systems

Based on our earlier work we propose a systematic method for symbolically computing the Lyapunov characteristic exponents, briefly LCE, of n-dimensional dynamical systems. First, we analyze mathematically the LCE of n-dimensional dynamical systems. In particular, as an example, we discuss the LCE of the Lorenz systems. Then, to do the above task, a framework on representation and manipulation of a class of non-algebraic objects using non-standard analysis is established, in which an algorithm can be developed for deriving unknown relations on some objects involving limit processes. Finally, applying this algorithm on n-dimensional dynamical systems, we show that their maximal LCE can be derived mechanically; particularly, for the Lorenz systems, we obtain a result on the maximal LCE of these systems.