



Chaos Detection and Predictability [

Skokos, Charalampos Haris

Gottwald, Georg A

Laskar, Jacques

Physics

Physical geography

Mathematical physics

Space sciences

Statistical physics

Physics

Nonlinear Dynamics

Mathematical Methods

in Physics

Mathematical Applications in the Physical Sciences

Extraterrestrial Physics, Space Sciences

Earth System Sciences

Monografía

Distinguishing chaoticity from regularity in deterministic dynamical systems and specifying the subspace of the phase space in which instabilities are expected to occur is of utmost importance in as disparate areas as astronomy, particle physics and climate dynamics. To address these issues there exists a plethora of methods for chaos detection and predictability. The most commonly employed technique for investigating chaotic dynamics, i.e. the computation of Lyapunov exponents, however, may suffer a number of problems and drawbacks, for example when applied to noisy experimental data. In the last two decades, several novel methods have been developed for the fast and reliable determination of the regular or chaotic nature of orbits, aimed at overcoming the shortcomings of more traditional techniques. This set of lecture notes and tutorial reviews serves as an introduction to and overview of modern chaos detection and predictability techniques for graduate students and non-specialists. The book covers theoretical and computational aspects of traditional methods to calculate Lyapunov exponents, as well as of modern techniques like the Fast (FLI), the Orthogonal (OFLI) and the Relative (RLI) Lyapunov Indicators, the Mean Exponential Growth factor of Nearby Orbits (MEGNO), the Smaller (SALI) and the Generalized (GALI) Alignment Index and the (QA(B(3H(B0-1(QA(B(3I (Btest for chaos

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Contenido: Estimating Lyapunov exponents from time series -- Theory and applications of the fast Lyapunov Indicator (FLI) method -- Theory and applications of the Orthogonal Fast Lyapunov Indicator (OFLI and OFLI2) methods -- Theory and applications of the Mean Exponential Growth factor of Nearby Orbits (MEGNO) method -- The Smaller (SALI) and the Generalized (GALI) Alignment Indices: Efficient Methods of Chaos Detection -- The Relative Lyapunov Indicators: Theory and Application to Dynamical Astronomy -- The 0-1 Test for Chaos: A review

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Autores: Skokos, Charalampos Haris Gottwald, Georg A Laskar, Jacques

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Baratz Innovación Documental

- Gran Vía, 59 28013 Madrid
- (+34) 91 456 03 60
- informa@baratz.es