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Book Review

Chaotic Dynamics. Tamás Tél and Márton Gruiz, Cambridge University Press, Cambridge, 2006

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For the more than three hundred years since the time of Newton the evolution and stability of mechanical systems, and especially that of the solar system, have been central in physics and mathematics. During the eighteen century Euler, Lagrange and Laplace made substantial developments in that subject area by predicting changes in the planetary orbits due to small perturbations, in that way establishing a framework for the study of global stability. All of this culminated in the nineteenth century work by Hamilton and Jacobi who reformulated the Lagrangian formalism of classical mechanics in terms of phase space, a step which proved to be most fruitful for developments in both statistical and quantum mechanics.

These successes consolidated the idea of *classical determinism*. However, at the end of nineteenth century, the works of Poincaré not only closed the door to an age but generated the first serious fracture in the philosophical conception of determinism. These works showed the impossibility of proving the convergence of perturbation series and, therefore relevant questions such as: is the solar system stable? remained unanswered. Poincaré was thus the first to study what much later has been called (apparently by J. Yorke in 1975) *chaos*.

In their book Tél and Gruiz give a plain, albeit not simplistic, definition of chaos: "Chaos is the complicated temporal behavior of simple systems." Thus, and contrary to common thinking, chaos is not spatial and static disorder but a characteristic of certain motions and is essentially a dynamical concept. Chaos may appear in a variety of fields: physics, chemical reactions, the spread of illnesses, economics and, of course, in planetary motions. For, contrary to intuition, chaotic behavior is not an exclusive property of dissipative systems but of conservative systems as well.

Among the many books on the subject published in recent years and that basically focus on interdisciplinary examples and applications, the emphasis of the present one is on classical mechanics which, in turn, enhances a hidden and quite forgotten issue: *classical indeterminism.* All in all, the book is very readable, only requiring an elementary knowledge of physics and mathematics rendering it suitable for science or engineering undergraduate students and for those in other branches of science wanting an introduction to the subject.

Tél and Gruiz' book consists of three parts having a total of ten chapters. These are devoted to topics like regular and chaotic motions, fractal objects, chaos in conservative and in dissipative systems, chaotic scattering and applications of chaos, among these, as most striking, I would single out chaos in the solar system and in fluid flows. The book has been carefully edited by Cambridge University Press and contains a complete and useful bibliography with many useful graphs and color plates and is otherwise highly recommended as an introductory text.

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