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Periodic motions, by Miklos Farkas, Appl. Math. Sci., vol. 104, Springer-Verlag, Berlin and New York, 1994, xiii+577 pp., $54.50, ISBN 0-387-94204-1

In the analysis of mechanical, biological, economic, electromagnetic and many other systems, the second thing that investigators look for (after equilibria) is a periodic motion. Such motions sometimes occur naturally (intrinsically) and sometimes are forced due to external circumstances. Sometimes they arise for all relevant values of given parameters, and sometimes only for certain ranges. Sometimes they occur as a result of bifurcations, and sometimes they occur due to time delays. All of the above are contained in the book by M. Farkas.

For those of us who work in the area of periodic phenomena, this book will become a standard reference. It describes most of the circumstances and techniques with respect to periodic solutions of ordinary differential equations with a short foray into functional differential equations.

The chapter titles are: 1. Introduction, 2. Periodic Solutions of Linear Systems, 3. Autonomous Systems in the Plane, 4. Periodic Solutions of Periodic Systems, 5. Autonomous Systems of Arbitrary Dimension, 6. Perturbations, 7. Bifurcations. There are also three appendices.

The first five chapters pull together standard topics in the subject, usually found here and there in texts on advanced ODE's. The fact that they are now together in a well-organized manner in one textbook will be a great boon to those interested in the subject. The most interesting chapters, in my opinion, are the last two, which contain topics of great current interest but which are not found in standard texts.

The chapter on perturbations deals with periodic perturbations of autonomous and nonautonomous systems utilizing various techniques, including the method of averaging, pioneered by the Soviet mathematicians and not so well known in the West. There are also sections on singular perturbations and aperiodic perturbations.

The bifurcations chapter discusses Hopf bifurcations and zip bifurcations before discussing FDE's and chaos. Applications to ecological systems are analyzed. For those who don't know, zip bifurcations were first discovered by Professor Farkas, describing how a singular curve unfolds into periodic solutions when a parameter changes, just like a zipper opening up.

All in all, the book is well worth owning for those with an interest in the subject, and a must for researchers in the area.

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