authors have made substantial contributions to the subjects treated here. They have done an admirable job in explaining the methods for studying dynamical systems, nonlinear oscillations and bifurcations. The book also provides the reader with sufficient ideas and background for reading research literature. Because many details are worked out explicitly, it is most helpful for those who are oriented towards applications. Exercises are an integral part of the book and it is strongly recommended that the reader work them out. Nonetheless, there are some exercises, especially in the seventh chapter, that are quite difficult and could be developed into graduate theses.

The book assumes implicitly that the readers are fully aware of the various applications of the treated subjects. Nonetheless, if the authors were to add a brief discussion of, and references to, current applications such as road maps, then this book could serve as a catalyst for theoretically oriented readers to venture into some concrete applications. It would also provide applications-oriented readers some additional applications. This would result in a more stimulating cross-fertilization, and I hope it will be done in a sequel.

In summary, I recommend this book highly for those who are motiviated to learn and for those who are just curious.

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Physics of Gravitational Systems

A. M. Fridman, V. L. Polyachenko
826 pp. (2 vols.) Springer-Verlag, New York, 1984. $57.00

Students and specialists alike will welcome this splendid monograph. The student who is familiar with the elements of kinetic theory and linear partial differential equations will find here an exceptionally clear and well-organized account of the modern theory of the structure and stability of collisionless gravitating systems. Specialists will be impressed by the authors' success in integrating nearly 500 sources into a coherent mathematical narrative.

The statistical theory of stellar systems was founded early in this century by Arthur Stanley Eddington and James Jeans. They took as their model the kinetic theory of gases developed in the previous century by James Clerk Maxwell, Rudolf Clausius and Ludwig Boltzmann.

Stellar systems behave very differently from ordinary gases, because of the long-range character of gravitation. The motion of a star in a rich cluster or galaxy is determined mainly by the slowly varying gravitational field of distant stars; the rapidly varying part of the field, produced by nearby stars, is much weaker. Consequently, the relaxation time of a rich cluster, calculated in the ordinary way, may be comparable to, or greater than, the age of the universe. The relaxation time of a galaxy is much longer than the age of the universe. If we neglect the weak fluctuating field entirely, we find that there is an infinite number of equilibrium configurations for a rich stellar system of given mass, energy and angular momentum.

Not all equilibrium configurations are stable against small perturbations, however. Methods for investigating stability and small oscillations in collisionless gases were first developed in the context of plasma physics and became the subject of an extensive literature. This literature has provided astrophysicists with their most important mathematical tools for investigating the stability of the equilibrium configurations of rich stellar systems. Volume I of the book under review gives a systematic account of these mathematical tools and their applications to gravitating systems. Each of the five main chapters treats systems having a particular kind of symmetry: nonrotating sheets, cylinders, spheres, ellipsoids and rotating discs. The discussion of each type of system is exhaustive, but the main ideas, methods and results are presented first and in considerable detail, so that students and nonspecialists should have little difficulty extracting what is of interest to them.

Volume II treats nonlinear collective processes: nonlinear waves, solitons, collisionless shocks and turbulence. It also discusses applications of the theory to actual astronomical systems, including globular clusters, spheroidal galaxies, the discs of spiral galaxies and planetary rings. This part of the book is unavoidably less satisfying than the purely theoretical parts, because present theories—powerful though they are—still leave important astronomical phenomena unaccounted for. For example, in all spheroidal stellar systems—including the invisible components of spiral galaxies—the distribution of mass seems to follow the density law appropriate to an isothermal gas sphere. This is the configuration of maximum entropy, so it would seem that spheroidal stellar systems are highly relaxed. Yet, as mentioned above, their relaxation times, calculated in the ordinary way, are much longer than the age of the universe.

The Russian edition of this book was published in 1976. The English version contains a great deal of new and revised material. For example, the section on Saturn's rings is entirely new. Unfortunately, the translation leaves much to be desired. The English is consistently unidiomatic, the proofreading of the text (but not of the equations) is sloppy, and many of the technical terms have been mistranslated. Fortunately, the mathematical arguments are so clearly presented that the inept translation presents a relatively minor annoyance.

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Medical Images and Displays

R. Stuart Mackay
276 pp. Wiley, New York, 1985. $44.95

R. Stuart Mackay's book provides a survey of all the present biomedical imaging systems. It starts with an overview discussing the various imaging modalities and then proceeds to describe each of these, emphasizing the physical principles.

The descriptions are more physical than mathematical so that the book can be read and understood quite easily by the physics or engineering undergraduate student. The major topics covered are: image formation, computed tomography, x rays, ultrasonography, nuclear magnetic resonance, spectral information, motion and flow, image processing, visual methods and displays.

The book is concerned with the explanation of concepts and does so clearly, in a style that is very readable. The figures and photographs are excellent; they are often taken from medical or biological research, including many from Mackay's own research.

Ultrasound imaging is extensively treated in considerable detail, and the material provides an excellent introduction to the advantages and shortfalls of ultrasonic procedures. It is very interesting to see the "observation" of tiny bubbles much smaller than the ultrasonic wavelength utilized for the imaging. The author shows that such observations are physically realizable, both practically and theoretically.

The subject of CAT scans is handled very well. Mackay shows how one obtains multiple projections of geometric objects and how one reassembles these projections to obtain an image. The image-reconstruction method is very well explained and undergraduates in any college program can easily understand it. Having taught this very topic to students of biophysics, bioengineering and electronic engineering, I found the treatment an improvement on my own teaching procedure.

For PET-scanning systems Mackay