Nonlinear vibrations in mechanical and electrical systems. By J. J. Stoker. New York, Interscience, 1950. 20+273 pp. $5.00.

Professor Stoker's book is an important landmark in the first decade of the studies of nonlinear problems in the United States and should be recommended to those who are interested in a systematic study of this subject. The presentation renders it particularly attractive to physicists and engineers owing to a considerable number of examples illustrating the various mathematical concepts such as singularities, limit cycles, and so on, which thus acquire an almost intuitive aspect. On the other hand, once this intuitive approach has been sufficiently prepared, the author proceeds with the necessary rigor to prove the existence theorems for these concepts introduced more or less on physical grounds.

As the author states in the introduction, it was necessary to restrict the subject to a somewhat limited number of selected topics in order to keep within the limits of the book. In fact, the Russian literature alone between 1929 and 1937 covers over 2000 pages of the various publications to say nothing of a considerable amount of the earlier material accumulated by Poincaré, Liapounoff, Bendixson, Birkhoff, and other forerunners in these studies. Nevertheless, Stoker's treatment of these selected topics is sufficiently broad to enable the reader to acquire the grasp of a much wider situation.

Perhaps the best way of abstracting the book is to proceed chapter by chapter as he does himself in his introduction. Chapter I is a short summary of the theory of linear vibrations for a system with one degree of freedom; it serves both as a reference and contrast for the nonlinear theory. Chapter II introduces the reader into the simplest case of nonlinear problems associated with the behavior of nonlinear conservative systems. The phase plane representation of integral curves is introduced in this chapter and is illustrated by a number of examples. Chapter III is also of a rather elementary character and deals with the differential equations of a more general type, namely, those which, in addition to the nonlinear restoring force, possess also a nonlinear damping. In this chapter the author gives an outline of the Liénard graphical method and closes the theoretical part by a summary of the theory and classification of simple singularities of the differential equations in real domain. The end of the chapter contains a number of physical examples illustrating the concept of singular points as various types of equilibria of dynamical systems. The last example concerning the behavior of the synchronous motor covers nearly 14 pages of the text and is treated in great detail.