Two books on superconductor electronics

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Superconducting Quantum Electronics. **V. Kose, Ed.,** Springer-Verlag, Berlin; Heidelberg; New York; London; Paris; Tokyo, 1989. 299 p.

The book contains 11 review papers written especially for this publication. It was called on to cover all aspects of both physical and also applied superconductor electronics. Since the circle of authors was limited to only scientists from one country (the Federal Republic of Germany), solving this problem met with variable success.

In the book's first part ("Fundamentals"), Lübbig's paper on the quantum limitations of classical Josephson dynamics is, as a whole, correct, but it does not given an adequate idea of the vigorous development of research in this field in the last several years. Brunk's paper is devoted to some asymptotic forms and approximations for the results of the microscopic theory of the Josephson effect. Although these results may be useful in developing electronic analogs for Josephson junctions, it appears to me that such a narrow theme might have been left out of the collection of articles. On the other hand, the paper by Pepel' which follows it, "The Electromagnetic Properties of Superconductors" serves as an embellishment of the collection. Although the author does not go beyond the bounds of the Mattis-Bardin theory, which became classical long ago, unlike most of the other papers, he shows the results of numerical calculations that have been made for practically important configurations and without prior simplifications which often reduce the value of the results. Most of the results are compared with experimental data (for low-temperature superconductors).

The second part ("Sensitive Detectors") is opened by Rogalla and Hayden's paper, which is mainly devoted to the technology of thin films, different types of Josephson junctions, and of squids based on such "classical high-temperature superconductors" as Nb_3Ge and NbN. Only the short last part of the paper describes the simplest three-dimensional squids of "real" (oxide) high-temperature superconductors. The following paper by Koch gives a good, even if short, review of the application of squids to biomedicine. In the paper "The Josephson Junction as a Spectroscopic Detector," Hinken describes in detail the well-known theory of the self-selective video response to microwave radiation (within the resistance model for a junction) and also the data from his preliminary experiments conducted at short millimeter wavelengths. Gundlach's review is devoted to superconductor quasiparticle ("SIS" and "SIN") video detectors and mixers. The practical problems of manufacturing and using such devices (which are already operating in a permanent regime on a number of radio telescopes) are described well in this review; in describing their theory, however, a number of important recent results are not included. Hübener's paper on such a fundamental (it is better to say, academic) question as scanning tunneling microscopy of superconducing thin films and of distributed Josephson junctions departs somewhat from the themes of this part of the book.

The last part of the book ("Precision Metrology") is opened by Niemayer's paper on multiple junction Josephson voltage standards and potentiometers. This field has been significantly indebted for its vigorous development in recent years to the author of the paper, so that the reader here has the opportunity to obtain at first hand well systematized, valuable information. The paper by Gutman and Bachmayr describes modern developments of cryogenic current comparators. Finally, in the paper by Albrecht and Kessel, an interesting attempt is described of the authors to create a generator of pseudo-random codes based on digital Josephson schemes for use as a white noise standard. Unfortunately, in the paper there is no analysis of the merits and drawbacks of such a complicated method in comparison with simpler ones.

Summarizing, one may note that there is considerable interesting, good quality material in the book, and it can be useful for scientific workers, engineers, and graduate students who are specializing in the field of superconductor electronics. At the same time, however, it represents one more demonstration of the fact that, for raising the quality of the papers of symposia on a relatively narrow theme, it is expedient to extend the sphere of choice of authors as much as possible, without being restricted to within one, even granted a very advanced, country.

J. H. Hinken. *Superconductor Electronics: Fundamentals and Microwave Applications.* Springer-Verlag, Berlin; Heidelberg; New York; London; Paris; Tokyo, 1989. 158 p. (Graduate Texts in Contemporary Physics).

The book is a translation into English of Professor Hinken's monograph, which appeared in German in 1988 by the same publisher.

The first chapter, "Fundamentals of Superconductivity" gives a review of the physics and theory of the phenomenon. Even though it is fairly logically written, it is hardly adequate for professional work in the field of superconductor electronics, and absolutely must be supplemented with some standard course (of the type of the well-known books by Tinkham, van Duser and Turner, or Schmidt). Applications to microwave technology of "quasiparticle" (one-electron) tunneling in superconductor tunneling junctions are described in the second chapter. Unlike Gundlach's review (see above), the most attention is paid to the theory of video detection and frequency mixing of such junctions, even if the lastest results of this theory are not reflected here.

The short third chapter of the book is devoted to the fundamentals of the dynamics of Josephson junctions and squids, and mainly contains canonical material. The fourth chapter ("The Application of Josephson functions in Microwave Technology"), which describes the field of the author's personal interests, is significantly more original. The principles of operation of such devices as voltage standards, video detectors (operating both in a broad-band and also in a self-selective regime, which the author calls spectroscopic),

mixers (only with external heterodynes), parametric amplifiers (with self-pumping and external pumping), and microwave generators are considered in it.

The final two chapters (the fifth and sixth) of the book are devoted to secondary, but important, questions: to the materials (with a small section on high-temperature superconductors) and technology of manufacturing superconductor electronic devices and to provision for their cryogenics. Even though the explanation here is very short and does not go beyond well-known reviews and monographs, the concentration of this material in a book of small size may be very useful. This allows me to recommend Hinken's book as an introductory text for students of upper undergraduate courses, graduate students and engineers starting to work in the field of microwave superconductor electronics, and as a reference aid for specialists in related fields.

In general, the almost simultaneous appearance in the Federal Republic of Germany of two books on superconductor electronics reflects an acceleration of the development of this field occurring throughout the world, which began even somewhat before the "advent" of high-temperature superconductivity.

Translated by Frederick R. West