

Book Review

ADVANCES IN PERMANENT MAGNETISM

by R.J. Parker. John Wiley and Sons, New York, 1990, 337 pp, £65.00

This monograph is a revised and updated edition of the book by Parker and Studders, first published in 1962. Since the first edition, considerable progress has been achieved, particularly in the field of rare-earth magnets. This development has been so rapid that even a freshly published monograph becomes obsolete shortly, and a reader must inevitably resort to a large number of fragmented papers on the subject.

The book is addressed to all those interested in the design and applications of permanent magnet systems, and those dealing with rare earths will find there a wealth of useful material. Following an introduction, there are chapters on magnetism and permanent magnets, the physics of permanent magnetism, classification of permanent magnets, stability, design relationships, and property selection, the application of permanent magnets, measurements of magnetic properties, and magnetization and demagnetization of permanent magnets.

Magnetic and physical properties of permanent magnets and demagnetization curves are also included as separate appendices.

Since the book is intended mainly for the design engineer, the author introduces as little physics as possible. Such an approach, however, makes an understanding of fundamental principles of magnetism as applied to permanent magnets rather formidable. In addition to clumsy and shallow treatment of physical phenomena, insufficient and unclear explanation of graphical representations of magnetization phenomena and inconsistent introduction of various physical parameters, will frustrate the more inquisitive reader.

On the other hand, the chapter on the classification of permanent magnets and processing technology contains a most useful, updated review of currently used permanent magnets, their properties and processing technology. The chapter on permanent magnet stability summarizes the effects of temperature, magnetic field and other variables on reversible, irreversible, and structural changes in permanent magnets. The value of this well written and illustrated chapter is enhanced by the inclusion of a discussion of rare-earth magnets, particularly of SmCo_5 .

The section on design relationships and property selection describes the selection of properties so that the magnet geometry is found to meet the requirements of the magnetic circuit design. The economic considerations are analyzed in terms of magnet size and energy density. The chapter on magnetization and demagnetization will be of great value particularly to those who work with high-coercivity rare-earth magnets.

The technical sections of the book are written in a lucid style, although the jargon of informal workshop conversation is occasionally employed. Explanations of physical magnetic phenomena are often cumbersome, and do not lend themselves to a more detailed analysis. The presentation of the book is first class (high-quality paper and print, and excellent illustrations), although poor proof-reading has resulted in numerous typographic errors. Another indication of the haste in which the book was probably prepared is the non-systematic and chaotic usage of symbols. For instance, in the text K is used to denote a scaling factor, a variable coefficient, and an undefined constant. The list of symbols defines K as anisotropy constant.

Similarly, e is used, among other things, for e.m.f. voltage and Hall voltage, while in the glossary e is defined as the electron charge. The glossary also contains several unconventional and puzzling definitions of physical quantities. For example, ferromagnetic material is defined as "a paramagnetic material which exhibits a high degree of magnetizability", μ_0 is called "magnetic constant", while μ is "permeability". NI is called "ampereturns", while the number of turns is denoted as n , and N is used to denote the demagnetization factor.

In summary, this is a welcome update on new and exciting developments in permanent magnetism, and the author must be commended for attempting to simplify and reconcile a rather difficult and rapidly changing topic. Unfortunately, in abstaining from lucid physics and exact mathematics, he has not made permanent magnetism simpler.

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