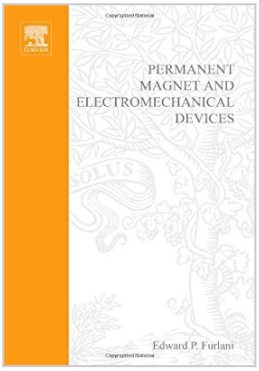

Permanent Magnet and Electromechanical Devices: Materials, Analysis, and Applications (Electromagnetism)

By Edward P. Furlani

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The book provides both the theoretical and the applied background needed to predict magnetic fields. The theoretical presentation is reinforced with over 60 solved examples of practical engineering applications such as the design of magnetic components like solenoids, which are electromagnetic coils that are moved by electric currents and activate other devices such as circuit breakers. Other design applications would be for permanent magnet structures such as bearings and couplings, which are hardware mechanisms used to fashion a temporary connection between two wires.

This book is written for use as a text or reference by researchers, engineers, professors, and students engaged in the research, development, study, and manufacture of permanent magnets and electromechanical devices. It can serve as a primary or supplemental text for upper level courses in electrical engineering on electromagnetic theory, electronic and magnetic materials, and electromagnetic engineering.

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Permanent Magnet and Electromechanical Devices: Materials, Analysis, and Applications (Electromagnetism) By Edward P. Furlani Bibliography

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Editorial Review

From the Back Cover

Permanent Magnet and Electromechanical Devices: Materials, Analysis, and Applications is a comprehensive and self-contained exposition of the theory and methods used in the analysis and design of permanent magnet and electromechanical devices. It contains extensive discussions of several key topics of applied magnetics, including the theory of ferromagnetism, a survey of magnetic materials, magnetostatic analysis, magnetic circuit theory, the design of
rare-earth permanent magnet structures, and the analysis of electromechanical devices. The book is a valuable text or reference for researchers, professors, engineers, and students engaged in the development of permanent magnet materials, computation of magnetic fields, analysis of magnetic circuits, design of permanent magnet structures, and development of electromechanical devices such as transducers, actuators, and motors. It can also serve as a primary or supplemental text for courses on applied magnetics, permanent magnetism, electromechanical energy conversion, or motion control. The book provides a rigorous theoretical foundation for the subject matter and demonstrates the application of theory to the implementation of practical designs. The theoretical presentation is reinforced with numerous illustrations and over 60 solved examples of practical applications.

· Extensive discussion of magnetic materials, including the physical principles of magnetism, domains, hysteresis, soft and hard magnetic materials and their properties, and the magnetization and stability of permanent magnets.
· Comprehensive presentation of analytical and numerical methods for the analysis of steady currents, permanent magnets, and magnetic circuits.
· Over 60 solved examples of practical permanent magnet and electromechanical applications
· Analytical analysis and design formulas for the field distributions of the most common rare-earth magnet structures and the performance of rare-earth magnetic couplings, gears, and bearings
· Extensive discussion of the theory of electromechanical devices with numerous solved examples
· Analytical analysis and design formulas for linear and rotational actuators, brushless DC motors, and stepper motors
· Presentation of a hybrid analytical-FEM approach to analysis of electromechanical devices
· Introduction to magnetic microactuators

About the Author

Dr. Edward Furlani holds BS degrees in both physics and electrical engineering, and MS and PhD degrees in theoretical physics from the State University of New York at Buffalo. He is currently a research associate in the research laboratories of the Eastman Kodak Company, which he joined in 1982. He has worked in the area of applied magnetics for over 15 years. His research in this area has involved the design and development of numerous magnetic devices and processes. He has extensive experience in the analysis and simulation of a broad range of magnetic applications including rare-earth permanent magnet structures, magnetic drives and suspensions, magnetic circuits, magnetic brush subsystems in the electrophotographic process, magnetic and magneto-optic recording, high-gradient magnetic separation, and electromechanical devices such as transducers, actuators and motors. His current research activity is in the area of microsystems and involves the analysis and simulation of various micro-electromechanical systems (MEMS) including light modulators, microactuators and microfluidic components. Dr. Furlani has authored over 40 publications in scientific journals and holds over 100 US patents.

Foreword:

This volume in the Academic Press Series in Electromagnetism presents an in-depth, self-contained, and up-to-date treatment of permanent magnets and related electromechanical devices. The emergence of modern rare-earth permanent magnets has led to the tremendous proliferation of devices that utilize these magnets. Currently, there does not exist any book that presents comprehensive treatment of permanent magnet technology and covers material aspects, field analysis, and wide-ranging device applications of permanent magnets. This book, written by Dr. Edward P. Furlani, represents the first and successful attempt to give the exposition of all these issues within one volume.

The book reflects the author’s extensive experience as well as his intimate and firsthand knowledge of the area of permanent magnet technology. The unique feature of this book is its broad scope and the proper and delicate balance between theoretical and applied aspects of permanent magnet devices. The book is intended for readers without extensive experience or knowledge in the area of permanent magnets. It reviews the physics of magnetic materials and the basics of electromagnetic field theory. Then, it presents in detail the analysis and design of the wide range of permanent magnet devices such as magnetic gears, couplings, bearings, magnetic resonance imaging devices, free-electron laser magnets, magnetooptical recording systems, permanent magnet motors and stepper motors, and, finally, magnetic microactuators (MEMS). The book contains a large number of practical design examples that are completely worked out. This feature will help readers to follow all the computational and design steps involved in the development of new devices and will be very beneficial for graduate students and practicing engineers.

I believe that this book will be a valuable reference for both experts and beginners in the field. Electrical and mechanical enginers, applied physicists, material scientists, and graduate students will find this book very informative.

Isaak Mayergoyz
Series Editor

Users Review

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