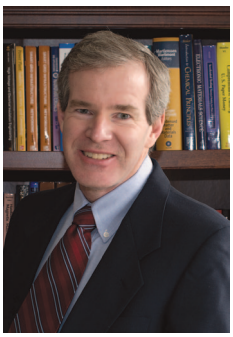

by John J. Shea

Magnetic Materials and 3D Finite Element Modeling

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This book is for those readers who model magnetic materials, especially those doing 3D finite element modeling (FEM) of transformer cores. The book has three parts. The first part introduces the background to electromagnetic analysis, mainly Maxwell's equations—electrostatics, magneto-statics, magnetic materials, inductance, and field potentials. The second part presents ferromagnetic material characterization and modeling, including electrical losses and hysteresis modeling using a scalar and vector method; it is a good introduction to the basic concepts used to model losses in magnetic materials. The third part focuses on FEM. The Galerkin method, a way to convert a continuous operator problem (e.g., a differential equation) into a discrete problem, is used for the associated calculations, and 3D formulations are developed using the source-field method. The authors do not simply use a commercial software package, but rather show the reader how to develop the equations used in 3D FEM models. After reading this part of the book the reader will not only be able to develop his or her own equations describing 3D FEM of magnetic core materials, but will also have gained a deep understanding of magnetic core modeling methods and magnetic core behavior.

Anyone who wants to learn how to model magnetic cores, especially transformer core materials, in 3D will find this book extremely useful.

Intuitive Analog Circuit Design, 2nd Edition

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720 pp., $75.95 (Hardcover), 2014

We live in an analog world. Analog electronic building blocks, including operational amplifiers, transistor amplifiers, analog-to-digital (A/D) and digital-to-analog (D/A) converters, comparators, phase-locked loops, and voltage references, are used to interact with the world around us. There is, therefore, a great need for electrical engineers to understand how to design analog circuits.

This handbook describes intuitive and "back of the napkin" techniques for designing and analyzing analog circuits, including transistor amps, noise analysis, thermal design considerations, magnetic circuit design, and control systems. Circuit design is developed with a minimum of mathematics. The author outlines ways of thinking about analog circuits and systems that develop the reader's ability to recognize a good working analog circuit when he sees one.

The book covers a potpourri of important circuits, techniques, tricks, and analysis tools useful for designing real-world analog circuits. References are provided at the end of each chapter to enable the interested reader to explore topics in greater depth. It is assumed that the reader has some background with Laplace transforms, pole-zero plots, Bode plots, the step response concept, and a basic understanding of differential equations. A chapter uses examples to review the essence of these background fundamentals.

The remainder of the book covers device physics, analog circuit designs, and analysis tools. Device physics includes a review of diode physics (ideal and nonideal) and bipolar junction transistor models. Analog circuit designs deals with bipolar junction transistor amplifiers, advanced amplifier topics, field-effect transistor amplifiers, operational amplifiers (Op amps), and low-pass filters. Analysis tools presents practical advice on passive components, prototyping issues, PC board layout, noise, thermal circuit analysis, transmission line effects, and comments on using SPICE.

Each circuit schematic comes with a very good written explanation of the circuit operation, accompanied by supporting materials (graphs, tables, LTSPICE models, practical information, and references) which develop further understanding and impart an intuitive feel for circuit design. The author uses LTSPICE models throughout the text. There is an entire website, available at zero cost, which contains all the PowerPoint presentation slides for the book, SPICE files for each circuit, datasheets, and a copy of each referenced patent.

This is an excellent book for an advanced class in electrical engineering or for analog-circuit designers who want to learn quickly about analog circuits and apply that knowledge to designing and building real circuits. Unlike typical circuit cookbooks, this book provides the reader with an understanding of circuit operation and the knowledge required to modify a design so that it works in the way he wishes.

Build Your Own Electric Vehicle, 3rd Edition

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http://www.mhprofessional.com
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410 pp., $30 (Softcover), 2014

Build Your Own Electric Vehicle (EV) is a very interesting book. It is filled with up-to-date information on each component of an EV, i.e., motor, batteries, controller, charger, and chassis. It shows how to assemble the parts, how to select the right chassis in order to convert a gasoline-power vehicle to electrical operation, exclusive web content featuring current part suppliers and dealer lists, and very good technical background on lithium battery chemistry, recharging, and DC electric motors. Charts on horsepower, torque, and current for electric motors, and detailed tables showing required motor torque at different vehicle speeds and inclines, are presented, and available motor torque at different motor speeds and transmission gear ratios are explained. Calculations of the acceleration and maximum speed achievable using a given motor with given horsepower, for a given vehicle weight and incline, are explained.

Separate chapters explain each component of the EV system, and how to convert a gasoline-powered car into an electric-powered car. There are many photos and descriptions of commercially available EVs, interesting information on their performance, and comparisons with gasoline-powered engines. There is advice on selecting a chassis for value and functionality (for EV conversion), an electric motor, and a battery system. To help in motor selection, four different types of DC motor (series, shunt, compound short-shunt, compound long-shunt) are compared graphically, showing various performance parameters (torque and speed) versus armature current and shaft horsepower, and providing answers to a number of questions about the car's desired performance and expected driving conditions. The chapter on batteries compares lead- acid with new lithium types and focuses on the new lithium types for EV applications.

This is an interesting book, especially for do-it-yourselfers (DIY) and those who want to learn more about EVs and the technical details involved in selecting components for the EV system.

Practical Microwave Circuits

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Modern wireless devices are designed using RF and microwave circuit analysis methods. This book presents analytical techniques for understanding and designing high-frequency circuits. The author presents circuit analysis methods to characterize circuits, e.g., scattering (or S)-parameters, and applies nodal analysis and graph theory to analyze hybrid circuits and baluns commonly used in microwave circuits.

The book consists of three sections. The first covers background, i.e., transmission line theory, coupled transmission lines, and S-parameters. These topics give the reader the background required for the remainder of the book. This section could be skipped by those readers already having this knowledge. The second section deals with circuit analysis and design methods. It covers matching circuits, distributed networks, graph analysis, nodal analysis, and circuit/component modeling. These topics provide the reader with the analysis techniques required to design efficient microwave circuits. The third section deals with application of the methods described in the previous section. It contains details on active two-port circuits, including various amplifier designs (bipolar and FET), four port hybrid circuits, and balun design.

Even though background theory is presented, it is frequently assumed that the reader has some familiarity with fundamental circuit theory and electromagnetic theory. Certain commonly used microwave circuits are thoroughly covered, with discussion of noise effects, stability, and the effect of enclosure on circuit performance. Although examples are presented, more familiar examples and more complete circuit design examples would be desirable. Surprisingly, only a few examples using Smith charts are presented. Other circuit analysis methods (graphical and nodal analysis) are mainly used.

This book covers the essential methods used to analyze and design practical microwave circuits.

Measurement Instrumentation and Sensors Handbook, 2nd Edition

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(Hardcover, 2 volume set), 2014

The second edition of this handbook comes in a two-volume set, reflecting an extensive range of state-of-the-art methods for measurement, instrumentation, and sensor technology. With 40 new chapters, it describes instrumentation and measurement techniques for performing practical measurements in engineering, physics, chemistry, and the life sciences. It also discusses more fundamental properties of processing and data acquisition measurement systems, including reduction and analysis, operation characteristics, accuracy, errors, calibrations, and standards for control processes. Emphasis is placed on modern intelligent instruments and techniques, wireless networks, human factors, and modern display methods including virtual instruments.

The first volume has 10 parts and a total of 96 chapters. It focuses on instrumentation and measurement concepts in the areas of spacial variable measurements, displacement, mechanics, acous-

tics, flow and spot velocity, thermal and temperature measurements, and radiation.

The second volume also has 10 parts and a total of 98 chapters. It focuses on sensors and sensor technology in the areas of electromagnetics, time and frequency, optics, chemistry, biomedicine, environmental measurements, signal processing and display methods.

Both volumes contain a very comprehensive listing of practical methods used to sense or measure a given quantity, e.g., four different methods for measuring inductance, namely current-voltage, bridge, differential, and resonance; descriptions and circuit diagrams are included. All chapters present multiple methods for measuring a given quantity and describe the advantages and disadvantages of each method, providing the reader with an excellent technology background and a choice of measurement techniques.

Engineers, involved with instrumentation and measurement, will find this book an outstanding "go to" resource, with very broad coverage and detailed descriptions of modern measurement methods and techniques.

Electrical Insulation for Rotating Machines, 2nd Edition

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$135 (Hardcover), 2014

Those of you familiar with the first edition of this book will know that it is an invaluable resource, covering the design, evaluation, aging, repair, and testing of rotating electrical equipment. It deals with all aspects of electrical insulation used in motors and generators of all ratings, including rotor and stator windings, the materials and manufacturing methods used in the insulation systems, and new and legacy designs. It discusses the selection of insulation for new machines and describes more than 30 different rotor and stator failure mechanisms, repair methods, and mitigation of the aging process. Interpretation of diagnostic tests, and monitoring of systems that can be used to assess the condition of insulation, are also covered.

This second edition covers developments in rotating machine insulation over the past decade, including the effects of electric drives on rotating machine insulation, new failure mechanisms, and new diagnostic tests. Changes to standards, photographs of degraded insulation systems, information on Chinese and Indian machine manufacturers, and more references are also presented.

This book is incredibly useful for engineers diagnosing problems in rotating machines. Failure mechanisms in general, root causes of failure, and common symptoms and solutions are covered, giving the reader a practical way to go about diagnosing faults and solving problems. Engineers, researchers, developers, and manufacturers of insulation systems for rotating electrical machines will benefit greatly from this book.

On-Load Tap-Changers for Power Transformers

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www.reinhausen.com
ISBN 978-3-931954-47-5
266 pp., 98.90 EUR (Hardcover), 2014

A tap changer is a connection point selection mechanism along a power transformer winding, allowing a variable number of turns to be selected in discrete steps. The result is a transformer with a variable turns ratio, enabling stepped voltage regulation of the output. The tap selection may be made via an automatic or a manual tap changer mechanism. There are two types of tap changers, namely no-load and on-load. The no-load tap changer is switched when the load is not energized, whereas the on-load changer is switched when the load is energized and current may be flowing through it. Traditionally, tap changers use metal contacts under oil to provide effective switching. The on-load tap changer (OLTC) is used to select a tap to change and transfer power to the selected tap without interrupting the power flow. Today, almost all types of generators and power transformers are equipped with OLTC. However, contact arcing during switching under load causes breakdown of the oil, which eventually has to be replaced.

This book describes modern OLTCs in detail and the principles of their operation. It begins with an excellent overview of the history and design of the two different types of OLTC used today. These two types differ mainly in the method of transferring contact, i.e., resistive or inductive. (When switching between two taps, a resistive or inductive load is applied between the two contacts to prevent the transformer windings from shorting.) Inductive loading is generally used in the United States and resistive loading in other parts of the world. Both methods are described in detail. One of the main focus topics is tap changers using vacuum interrupters to replace under-oil switches. High-speed switching operation when using vacuum interrupters for resistive or inductive operation is described in detail.

After reviewing the fundamental operation of OLTCs, the selection of an OLTC for a specific application is discussed. Circuits for regulating delta, neutral end, boost, and autotransformers with OLTCs are also described. Other important factors in tap changer design, e.g., voltage stress during impulse testing, switching capacity, control of switching transients, and leakage inductance of winding arrangements, are considered. Applications of OLTCs for special switching sequences, phase shifting transformers, HVDC converter transformers, and parallel operation of transformers are included.

This is a unique and long-overdue book in an area that receives very little attention in university courses and in engineering in general. It provides an up-to-date review of modern OLTCs and an insight into tap-changer technology. Its coverage of background information and applications make it an invaluable resource for those who use, specify, or research OLTCs.