

Transformers: Analysis, Design, and Measurement

By Xose M. López-Fernández

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Transformers: Analysis, Design, and Measurement By Xose M. López-Fernández

Recent catastrophic blackouts have exposed major vulnerabilities in the existing generation, transmission, and distribution systems of transformers widely used for energy transfer, measurement, protection, and signal coupling. As a result, the reliability of the entire power system is now uncertain, and many blame severe underinvestment, aging technology, and a conservative approach to innovation.

Composed of contributions from noted industry experts around the world, **Transformers: Analysis, Design, and Measurement** offers invaluable information to help designers and users overcome these and other challenges associated with the design, construction, application, and analysis of transformers. This book is divided into three sections to address contemporary economic, design, diagnostic, and maintenance aspects associated with power, instrument, and high-frequency transformers.


Topics covered include:

- Design considerations
- Capability to withstand short circuits

- Insulation problems
- Stray losses, screening, and local excessive heating hazard
- Shell type and superconducting transformers
- Links between design and maintenance
- Component-related diagnostics and reliability
- Economics of life-cycle cost, design review, and risk-management methods
- Parameter measurement and prediction

This book is an essential tool for understanding and implementing solutions that will ensure improvements in the development, maintenance, and life-cycle management of optimized transformers. This will lead to enhanced safety and reliability and lower costs for the electrical supply. Illustrating the need for close cooperation between users and manufacturers of transformers, this book outlines ways to achieve many crucial power objectives. Among these, the authors focus on the growing demand for transformer miniaturization, increased transmitted power density, and use of advanced materials to meet the requirements of power materials running under higher operational frequencies.

Suggesting ways to redirect resources and exploit new technologies—such as computational modeling software—this book presents relatively inexpensive, simple, ready-to-implement strategies to advance transformers, improve power system integrity, reduce environmental impact, and much more.

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Transformers: Analysis, Design, and Measurement By Xose M. López-Fernández Bibliography

- Rank: #4515298 in eBooks
- Published on: 2016-04-19
- Released on: 2016-04-19
- Format: Kindle eBook

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Editorial Review

Review

"This book is a very practical and interesting book in that it covers important areas critical to the operation of a transformer that tend to be overlooked by most transformer design books while emphasizing near-term future trends in transformer design. This would be an excellent resource for anyone who designs or works with the types of transformers discussed. All information references IEC standards, so some of the testing criteria may be different for other standards such as ANSI or UL, but the fundamentals remain relevant no matter which standard is being applied."

--John J. Shea, *IEEE Electrical Insulation Magazine*

About the Author

Xose M. Lopez-Fernandez received his MSc in electrical engineering and his European Ph.D (with first-class honors) in electrical engineering from Vigo University, Spain, in 1992 and 1997, respectively. He is currently a professor in the Department of Electrical Engineering at that school and was a visiting professor at the University of Artois, Bethune, France. Professor Lopez-Fernandez is the founder and general chairman of the International Advanced Research Workshop on Transformers (ARWtr). He is currently being entrusted with the responsibility of leading research projects for Spanish and Portuguese utilities and power transformer manufacturers. His research interests include the design aspects of electrical machines. Dr. Lopez-Fernandez received the Alfons Hoffmann's Medal from the Polish Power Engineering Society in 2004. He is a member of the IEEE-PES Transformers Committee as well as CIGRE.

H. Bulent Ertan received his BS and MS in electrical and electronics engineering (EEE) in 1971 and 1973, respectively, from the Middle East Technical University (METU) in Ankara, Turkey. He also received his Ph.D from the University of Leeds, England, in 1977. He then joined METU as a staff member in that same year. Professor Ertan is currently a staff member of the Department of Electrical and Electronics Engineering at METU. His research interest is in the area of electrical machine design and electrical drives, and he has consulted for a number of companies manufacturing electrical motors and drives in Turkey. He has directed more than 20 industry-financed research projects and many other projects financed by the Turkish Scientific and Technological Research Institute (TUBITAK). He has served as the assistant director of TUBITAK Information Technologies and Electronics Research Institute since 1999 and led the Intelligent Energy Conversion Systems Research Group at TUBITAK-SPACE Institute for 8 years.

Janusz Turowski, Ph.D, DSc electrical engineering, served as full professor (retired in 2003) in electrical machines and applied electromagnetics at the Institute of Electrical Machines and Transformers (now Institute of Mechatronics and Information Systems), Technical University of Lodz (TUL), Poland. From 1999 to 2010, he was a full professor and dean at the Academy of Humanities and Economics at TUL. He received an honorary degree from the University of Pavia, Italy, in 1998. He is also a full member of the International Academy of Electrotechnical Sciences, a member of CIGRE, and a senior member of IEEE. He served as the director of IEMT from 1973 to 1992. Dr. Turowski served as a consultant of Polish ministers

and transformer works in Poland, India, China, Australia, and Canada. He is the past president and an honorary member of the Polish Association of Theoretical and Applied Electrotechnical Sciences (PTETiS).

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