



Being one of the most expensive and important elements, a power transformer is a highly essential element, whose failures and damage may cause the outage of a power system. In practice, transformer condition assessment is mainly conducted by experts or trained on-site engineers based on a number of diagnostic techniques. In recent years, computational intelligence techniques have been widely utilized for advancing power transformer condition assessment methods. This book presents a number of novel intelligent techniques and approaches to deal with power transformer winding distortion and deformation assessment problem based on frequency response analysis and incipient faults classification problem in oil-filled power transformers based on dissolved gas analysis. Both theoretical introduction to the subject and practical examples using experimental measurements and simulation results are given. This book will benefit anyone associated with power transformer modelling and conditional assessment. It will also be useful for those working on applying computational intelligence to solving parameter identification and decision making problems in technical systems.

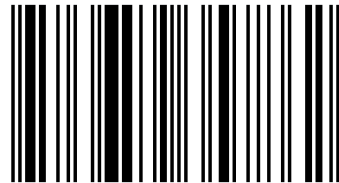
Almas Shintemirov

# Intelligent Modelling and Condition Assessment of Power Transformers



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978-3-659-35786-2

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Assessment of Power Transformers**

**LAP LAMBERT Academic Publishing**

## **Impressum / Imprint**

Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

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Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

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Coverbild / Cover image: [www.ingimage.com](http://www.ingimage.com)

Verlag / Publisher:

LAP LAMBERT Academic Publishing

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AV Akademikerverlag GmbH & Co. KG

Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Deutschland / Germany

Email: [info@lap-publishing.com](mailto:info@lap-publishing.com)

Herstellung: siehe letzte Seite /

Printed at: see last page

**ISBN: 978-3-659-35786-2**

Zugl. / Approved by: Liverpool, The University of Liverpool, PhD Dissertation, 2009

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To my family



# Preface

Being one of the most expensive and important elements, a power transformer is a highly essential element, whose failures and damage may cause the outage of a power system. This may further lead to a standstill of dependable technological processes and, hence, to multiple financial losses. The transients occurring during transformer failure could affect major equipment of the interconnected power subsystems and, thereby, cause switching off of the latter by means of relay protection.

Computational intelligence techniques have been widely utilized for advancing power transformer condition assessment methods. This book presents a number of novel intelligent techniques and approaches to deal with power transformer winding distortion and deformation assessment problem based on frequency response analysis (FRA) and incipient faults classification problem in oil-filled power transformers based on dissolved gas analysis (DGA). Both theoretical introduction to the subject and practical examples using experimental measurements and simulation results are given. This book will benefit anyone associated with power transformer modelling and conditional assessment. It will also be useful for those working on applying computational intelligence to solving parameter identification and decision making problems in technical systems.

The work presented in this book is split into two areas, where the main topic is power transformer winding modelling and condition assessment using FRA. The second topic is devoted to intelligent transformer fault classification using DGA. Chapter 1 of the book presents background materials on transformer winding condition assessment using FRA and DGA. Chapter 2 introduces fundamentals of com-



putational intelligence techniques utilised in this research. Chapter 3 reviews lumped parameter models of power transformer core and windings for FRA. Chapter 4 discusses distributed parameter models of transformer windings for FRA. Chapter 5 proposes a model-based identification approach of power transformer parameters using evolutionary algorithms on the basis of FRA measurements. Chapter 6 studies the interpretation techniques of FRA measurements and presents a decision making framework for transformer winding condition assessment based on an evidential reasoning approach. Chapter 7 presents an intelligent fault classification approach to power transformer DGA implementing genetic programming and bootstrap techniques to improve the DGA interpretation accuracy. Chapter 8 concludes the book summarising presented in the book results.

## Acknowledgments

This book presents the results of my 4 year doctoral research at the University of Liverpool, the United Kingdom. During my study I met many different people ready to help and to act as a source of inspiration. First of all, I express my sincere appreciation and acknowledgement to my supervisors, Professor Q. H. Wu and Dr. Wenhui Tang, for their constant support and guidance at every stage of this research work. They inspired me to experiment with many different ideas and made a great number of contributions, which allowed to complete this research project. Their intellectual advice, encouragement and invaluable discussions were the driving force in my work and have deeply broaden my knowledge in many areas, for which I am truly thankful.

Also I would like to thank the members of the Intelligence Engineering and Automation Group for their support and valuable discussions. Many thanks to Dr. Vivek Govinda, Dr. Thomas Hornik, Dr.

Zhen Lu, Dr. Andrew Tickle and Mr. Jonathan Buse for their friendship, which made my study in Liverpool interesting and versatile.

I am also indebted to Dr. N. Abeywickrama and Professor S. M. Gubanski from the Chalmers University of Technology, Göteborg, Sweden, for providing experimental data, and to Mr. H. Sun from the North China Electric Power University, Baoding, China, for valuable discussions on MTL models.

Many thanks go to the Department of Electrical Engineering and Electronics in the University of Liverpool, for providing research facilities that made possible conducting this research.

Financial support provided by the Center for International Programs of the Ministry of Education and Science of the Republic of Kazakhstan under the Presidential Bolashak Scholarship and the JSC Science Fund within the frame of the “Sharyktau” competition is immensely thanked and acknowledged.

Most of all, I want to thank my mam and dad, my sister Zhanna and brother Askhat, whose love and support miles away was a constant source of encouragement, without which this research work would not have been complete. I am deeply grateful to my wife Dinara for her love, patience, invaluable support and understanding through the whole period of my study in Liverpool. She gave me our beautiful children, Gulnaz and Alibek, and is constantly making my life rich and meaningful every day we are together.

*Astana, Kazakhstan  
March 2013*

*Almas Shintemirov*



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