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.

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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.

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Astana, Kazakhstan *Almas Shintemirov*
March 2013

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