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Power Switching Components

Theory, Applications and Future Trends

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Preface

This book on power switching components is the result of two courses, which have been taught by the authors at the University of Tehran and the Norwegian University of Science and Technology for more than 10 years. It is designed primarily to serve as a textbook for a one-semester university course for graduate or senior undergraduate students in electric power engineering or other related disciplines. It may also be used for self-study purposes, for persons with a general background in electrical engineering, as it contains many detailed and self-explaining examples. A selection of some parts of this book may also be used to cover the important topics on current interruption as a part of a more general course in high voltage apparatus or high voltage technology.

The authors have made efforts to make the present book reasonably compact, but at the same time to cover all the important topics related to power switchgears that use mechanically separating contacts and interrupt current by extinguishing the electric arc that burns between the separating contacts. The book begins with a phenomenological description of the current interruption process, where the role of switching arcs is explained. Thereafter, the main features and related physical phenomena of different interrupting media are discussed in detail. In the application chapter that follows, three basic aspects are considered: the characteristics of the different switching duties, derivation of mathematical expressions and formulas describing the stresses the switching device are exposed to, and the testing methods used to qualify switching equipment. The switching technologies currently applied are then covered, in part by describing design and operation principles of typical devices. Then follows a short review of reliability and service experience of switching devices, together with a review of diagnostic methods being applied for checking the condition of switching equipment in service. The book ends with an outlook on certain development trends and challenges for the future generations of power switching devices.

This book is indebted to all the invaluable well-written preceding books in the wide field of power switching devices. Among these are “High voltage circuit breakers” by R. Garzon, “Switching in electrical transmission and distribution systems” by R. Smeets and his colleagues and “The vacuum interrupter” by P. Slade.

The first author would like to thank his previous colleagues and employers, the University of Tehran, AREVA T&D as well as ABB, also for giving the permission to use some photos in this book. He is grateful to all graduate students of the University of Tehran, who attended the course on the theory and applications of power switching devices and contributed to refining the contents of this course. The first author would also like to thank Prof. Hossein Mohseni, a great friend, teacher and colleague, and Prof. Klaus Möller, who introduced him to the exciting world of current interruption.

The second author wants to express his great appreciation to the late Prof. Jarle Sletbak, who introduced him to the field of current interruption and switchgear technology, and also to students, colleagues and other associates in academia and industry that over the years have contributed to making this a rewarding area to work in.

It was not possible to write this book without the backing of our current employers, the Norwegian University of Science and Technology (NTNU) and SINTEF Energy Research, both located in Trondheim, Norway. We appreciate this support. Last, but certainly not least, we gratefully acknowledge the loving support of our wives, Nazanin Arab and Ingeborg Bordal.

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