

# Preface

A static compensator (STATCOM), also known as static synchronous compensator, is a member of the flexible alternating current transmission system (FACTS) devices. It is a power-electronics-based regulating device which is composed of a voltage source converter (VSC) and is shunt connected to alternating current electricity transmission and distribution networks. The voltage source is created from a DC capacitor and the STATCOM can exchange reactive power with the network. It can also supply some active power to the network if a DC source of power is connected across the capacitor. A STATCOM is usually installed in the electric networks with poor power factor or poor voltage regulation to improve these problems. In addition, it is used to improve the voltage stability of a network.

Over the last 20 years, several researches have been carried out around the world on STATCOMs and their results are published as journal and conference papers or technical reports. So far, STATCOMs have only appeared as a chapter or part of a chapter in some of the books on FACTS, power electronics, power systems, and reactive power compensation. However, to the best of the editors' knowledge, no single book has covered the different aspects of STATCOMs until now. The interested readers had to search among several hundreds of papers on STATCOM through different databases in order to build up their knowledge on the subject. This book is the first one entirely on STATCOM and it is an effort to provide a research-oriented, well-developed, and coherent book on the subject for postgraduate students and researchers. As the editors of the book, we hope it will prove to be a valuable addition to the literature on STATCOMs and be helpful to those interested in the subject.

This book is benefited from the inputs and comments of a large number of researchers and experts from the academia and industry. It contains 21 chapters. The breakdown of the chapters is as follows:

- Chapter 1 reviews the different topologies for the converters and filters used in the STATCOMs.
- Chapter 2 describes several multilevel converter topologies for STATCOMs.

- Chapter 3 discusses the analysis and implementation of an 84-pulse STATCOM.
- Chapter 4 presents the mathematical modeling of STATCOMs and control algorithms for STATCOMs.
- Chapter 5 discusses some control strategies for the STATCOMs.
- Chapter 6 presents the robust nonlinear control method for the STATCOMs.
- Chapter 7 describes the utilization of multiple reference frames for versatile control of STATCOMs.
- Chapter 8 presents the different control algorithms for multilevel STATCOMs.
- Chapter 9 discusses the adaptive observer for capacitor voltages in multilevel STATCOMs.
- Chapter 10 presents different methods of modeling and control of STATCOMs.
- Chapter 11 studies the STATCOM operation in steady state and dynamic modes in abc framework.
- Chapter 12 presents a load flow method considering the presence of STATCOM in power systems.
- Chapter 13 reviews different methods for optimal placement and sizing of STATCOMs in power systems based on heuristic optimization techniques.
- Chapter 14 discusses a multi-objective optimization technique to define the optimal placement of STATCOMs in power systems against short-term voltage instability.
- Chapter 15 demonstrates the application of STATCOM for increasing the available power transfer capability in transmission networks
- Chapter 16 presents the application of STATCOM for decentralized secondary voltage control in transmission networks.
- Chapter 17 provides an analysis for damping of subsynchronous oscillations with the help of STATCOMs.
- Chapter 18 demonstrates the STATCOM application for mitigation of subsynchronous resonance in wind farms that are connected to series-compensated transmission lines.
- Chapter 19 introduces two case studies for the application of STATCOM on Mexican power systems.
- Chapter 20 presents the stability analysis of STATCOM in distribution networks.
- Chapter 21 discusses the network protection systems in the presence of STATCOMs.

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