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Capacitor Based Power Converters

Design and Analysis

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As the world accelerates toward clean energy and electrified transportation, the demand for efficient, compact, and reliable power conversion systems continues to rise. Traditional two-level inverters can no longer meet the stringent performance standards of modern applications such as electric vehicles, renewable energy systems, and smart grids. In response, multilevel inverters (MLIs) have emerged as a powerful alternative, delivering superior voltage quality, reduced harmonic distortion, and enhanced overall efficiency.

This book provides a comprehensive exploration of multilevel inverter technologies, with a special focus on switched capacitor multilevel inverter (SCMLI) topologies—one of the most promising innovations in contemporary power electronics. It introduces an advanced 13-level SCMLI architecture capable of tripling input voltage without requiring bulky transformers, isolated DC sources, or complex clamping circuits.

Blending rigorous theory with practical design insights, the book guides readers through analysis, modelling, and implementation of high-performance inverter systems. It includes detailed design methodologies, simulation results, and performance comparisons with conventional MLIs. Applications in EV fast charging, photovoltaic systems, and grid-connected converters illustrate how these new architectures are bridging the gap between academic research and industrial deployment.

Comprehensive, accessible, and forward-looking, this work is an essential resource for researchers, engineers, and graduate students working at the forefront of clean energy conversion and advanced power electronics.

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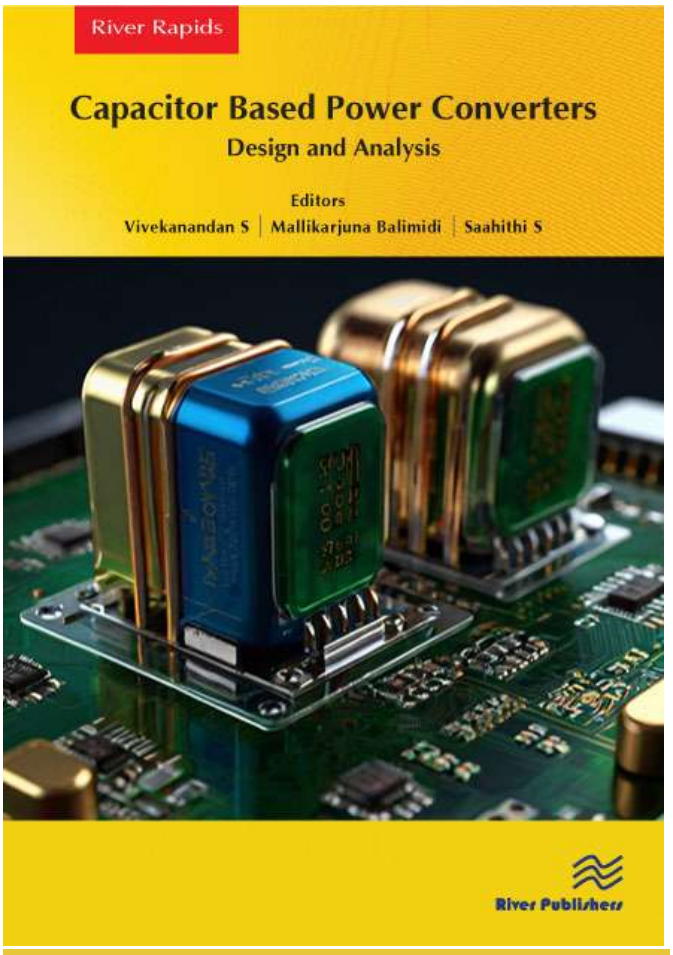

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