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Nota di contenuto	Transients of Modern Power Electronics; Contents; About the Authors; Preface; 1 Power electronic devices, circuits, topology, and control; 1.1 Power electronics; 1.2 The evolution of power device technology; 1.3 Power electronic circuit topology; 1.3.1 Switching; 1.3.2 Basic switching cell; 1.3.3 Circuit topology of power electronics; 1.4 Pulse-width modulation control; 1.5 Typical power electronic converters and their applications; 1.6 Transient processes in power electronics and book organization; References; 2 Macroscopic and microscopic factors in power electronic systems 2.1 Introduction 2.2 Microelectronics vs. power electronics; 2.2.1 Understanding semiconductor physics; 2.2.2 Evaluation of semiconductors; 2.3 State of the art of research in short-timescale transients; 2.3.1 Pulse definition; 2.3.2 Pulsed energy and pulsed power; 2.4 Typical influential factors and transient processes; 2.4.1

Failure mechanisms; 2.4.2 Different parts of the main circuit; 2.4.3 Control modules and power system interacting with each other; 2.5 Methods to study the short-timescale transients; 2.6 Summary; References

3 Power semiconductor devices, integrated power circuits, and their short-timescale transients 3.1 Major characteristics of semiconductors; 3.2 Modeling methods of semiconductors; 3.2.1 Hybrid model of a diode; 3.3 IGBT; 3.4 IGCT; 3.5 Silicon carbide junction field effect transistor; 3.6 System-level SOA; 3.6.1 Case 1: System-level SOA of a three-level DC-AC inverter; 3.6.2 Case 2: System-level SOA of a bidirectional DC-DC converter; 3.6.3 Case 3: System-level SOA of an EV battery charger; 3.7 Soft-switching control and its application in high-power converters

3.7.1 Case 4: ZCS in dual-phase-shift control 3.7.2 Case 5: Soft-switching vs. hard-switching control in the EV charger; References; 4 Power electronics in electric and hybrid vehicles; 4.1 Introduction of electric and hybrid vehicles; 4.2 Architecture and control of HEVs; 4.3 Power electronics in HEVs; 4.3.1 Rectifiers used in HEVs; 4.3.2 Buck converter used in HEVs; 4.3.3 Non-isolated bidirectional DC-DC converter; 4.3.4 Control of AC induction motors; 4.4 Battery chargers for EVs and PHEVs; 4.4.1 Unidirectional chargers; 4.4.2 Inductive charger; 4.4.3 Wireless charger

4.4.4 Optimization of a PHEV battery charger 4.4.5 Bidirectional charger and control; References; 5 Power electronics in alternative energy and advanced power systems; 5.1 Typical alternative energy systems; 5.2 Transients in alternative energy systems; 5.2.1 Dynamic process 1: MPPT control in the solar energy system; 5.2.2 Dynamic processes in the grid-tied system; 5.2.3 Wind energy systems; 5.3 Power electronics, alternative energy, and future micro-grid systems; 5.4 Dynamic process in the multi-source system; 5.5 Speciality of control and analyzing methods in alternative energy systems 5.6 Application of power electronics in advanced electric power systems

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## Sommario/riassunto

In high power, high voltage electronics systems, a strategy to manage short timescale energy imbalances is fundamental to the system reliability. Without a theoretical framework, harmful local convergence of energy can affect the dynamic process of transformation, transmission, and storage which create an unreliable system. With an original approach that encourages understanding of both macroscopic and microscopic factors, the authors offer a solution. They demonstrate the essential theory and methodology for the design, modeling and prototyping of modern power electronics converters to crea

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