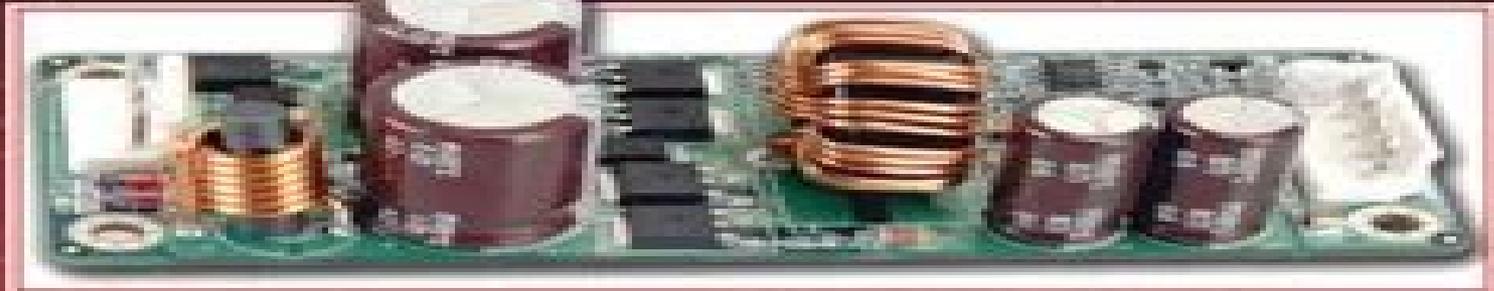


THIRD EDITION

# POWER-SWITCHING CONVERTERS



**SIMON ANG**  
**ALEJANDRO OLIVA**



CRC Press  
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# Power Switching Converters

**K. Kit Sum**



## **Power Switching Converters:**

**Power-Switching Converters** Dorin O. Neacsu, 2014-10-31 Power converters are at the heart of modern power electronics From automotive power systems to propulsion for large ships their use permeates through industrial commercial military and aerospace applications of various scales Having reached a point of saturation where we are unlikely to see many new and revolutionary technologies industry now seeks to optimize and standardize the performance of these devices

**Power-Switching Converters** Simon Ang, Alejandro Oliva, Gary Griffiths, Richard Harrison, 2010-12-20 Significantly expanded and updated with extensive revisions new material and a new chapter on emerging applications of switching converters Power Switching Converters Third Edition offers the same trusted accessible and comprehensive information as its bestselling predecessors Similar to the two previous editions this book can be used for a

Power-Switching Converters, Second Edition Simon Ang, Alejandro Oliva, 2005-03-17 After nearly a decade of success owing to its thorough coverage abundance of problems and examples and practical use of simulation and design Power Switching Converters enters its second edition with new and updated material entirely new design case studies and expanded figures equations and homework problems This textbook is ideal for senior undergraduate or graduate courses in power electronic converters requiring only systems analysis and basic electronics courses The only text of such detail to also include the use of PSpice and step by step designs and simulations Power Switching Converters Second Edition covers basic topologies basic control techniques and closed loop control and stability It also includes two new chapters on interleaved converters and switched capacitor converters and the authors have added discrete time modeling to the dynamic analysis of switching converters The final two chapters are dedicated to simulation and complete design examples respectively PSpice examples and MATLAB scripts are available for download from the CRC Web site These are useful for the simulation of students designs Class slides are also available on the Internet Instructors will appreciate the breadth and depth of the material more than enough to adapt into a customized syllabus Students will similarly benefit from the more than 440 figures and over 1000 equations ample homework problems and case studies presented in this book

Power-Switching Converters Dorin O. Neacsu, 2006-05-25 Power converters are at the heart of modern power electronics From automotive power systems to propulsion for large ships their use permeates through industrial commercial military and aerospace applications of various scales Having reached a point of saturation where we are unlikely to see many new and revolutionary technologies industry now seeks to optimize and standardize the performance of these devices Power Switching Converters Medium and High Power examines the characteristics and operating principles of these systems in terms of how to increase their efficiency and produce them at lower cost This book begins with an introduction to the field placing the technology in its business context to highlight the current trends and issues facing the modern power engineer The remainder of the book provides a detailed examination of three phase power switching converters including the various problems and solutions involved in different applications It discusses high power semiconductor devices pulse width modulation PWM principles and

algorithms for various implementations closed loop current control component minimized topologies power grid interface parallel and interleaved power converters and practical aspects such as protection and thermal management Filling the gap between textbooks and technical papers Power Switching Converters Medium and High Power offers practical solutions to current industrial demands with a focus on the particular business needs of performance quality and cost efficiency It also serves as an excellent textbook for graduate study

**POWER-SWITCHING CONVERTERS.** SIMON. OLIVA ANG (ALEJANDRO.),2023

**Switching Power Converters** Dorin O. Neacsu,2017-12-19 An examination of all of the multidisciplinary aspects of medium and high power converter systems including basic power electronics digital control and hardware sensors analog preprocessing of signals protection devices and fault management and pulse width modulation PWM algorithms Switching Power Converters Medium and High Power Second Edition discusses the actual use of industrial technology and its related subassemblies and components covering facets of implementation otherwise overlooked by theoretical textbooks The updated Second Edition contains many new figures as well as new and or improved chapters on Thermal management and reliability Intelligent power modules AC DC and DC AC current source converters Multilevel converters Use of IPM within a network of switches concept Power semiconductors Matrix converters Practical aspects in building power converters Providing the latest research and development information along with numerous examples of successful home appliance aviation naval automotive electronics industrial motor drive and grid interface for renewable energy products this edition highlights advancements in packaging technologies tackles the advent of hybrid circuits able to incorporate control and power stages within the same package and examines design for reliability from the system level perspective

*Troubleshooting Switching Power Converters* Sanjaya Maniktala,2011-04-08 Power Supply design is all about detail And a large part of that detail lies in the practical domain largely because of the typically small number of microseconds of switching periods involved and the even smaller tens of nanoseconds of switch transition times all these in effect accentuating various second order effects that eventually end up playing prime havoc with normal expectations of how the circuit should behave So not unsurprisingly even after reading several books most readers still find themselves no closer to the ultimate goal of designing an actual power supply Sooner or later all engineers start realizing the hard fact that designing a switching power supply isn't the trivial task it once seemed to be But even after years of successfully mastering the underlying theory the ultimate goal of creating a cost effective reliable and commercially viable power supply may still remain a distant dream since success ultimately hinges on experience That is in fact what clearly differentiates a senior and seasoned power supply engineer from the others the ability to navigate and surmount a veritable minefield of tricky issues that can only be learned the hard way by actual hands on experience on the job This book presents practical knowledge the author acquired rather painfully while working in the trenches for several years in major engineering companies scattered across several continents This is intended to be the mythical senior engineer's bag of tricks finally made available in the form

of an easy to read book on your shelf This book will make life for the ambitious power supply engineer much simpler besides reducing significantly the rigorous requirement of having to be a senior engineer's protégé for years on end just to gain a small measure of real success in this field A practical presentation that answers the important question why is my switching converter behaving so differently than what I was expecting on the basis of my paper design And how do I bridge that huge gap For the first time a systematic and thorough discussion of troubleshooting switching power supplies Coverage of AC DC and DC DC power supplies Bench Evaluation of semiconductor ICs used in power conversion describing standard and unusual techniques mastered by the author while testing similar chips at National Semiconductor Detailed coverage of vital topics that haven't been covered by available sources grounding systems the subtleties of component datasheets and using instruments and probes effectively Systematic investigation type of failure mechanism topology etc and solutions for 5 years of reported power supply issues on a prominent public web forum This approach will ensure that engineers will not repeat the same mistakes A unique readable style personal and direct no mystification just the plain truth easily and logically explained with plenty of pictures graphs and plots

**Power-Switching Converters** Simon Ang,Alejandro Oliva,2010-12-20 Significantly expanded and updated with extensive revisions new material and a new chapter on emerging applications of switching converters Power Switching Converters Third Edition offers the same trusted accessible and comprehensive information as its bestselling predecessors Similar to the two previous editions this book can be used for a

**Practical Switching Power Supply Design** Marty Brown,1990-03-28 Why use switching power supplies How a switching power supply works A walk through a representative switching power supply Switching power supply topologies Semiconductors used in a switching power supply The magnetic components within a switching power supply Cross regulation of the outputs Protection Miscellaneous topics Closing the loop feedback and stability Resonant converters an introduction Switching power supply design examples

Simplified Design of Switching Power Supplies John Lenk,1995 An introduction to switching power supply design for students experimenters and serious hobbyists with no experience in circuit design and a quick reference and book of tricks for veteran technicians and engineers Concentrates on the use of integrated circuit regulators and external components that modify the characteristics of the circuit package The designs shown can be used immediately or adapted for special application Annotation copyright by Book News Inc Portland OR

*Switch Mode Power Conversion* K. Kit Sum,2017-07-28 First Published in 2017 Although the concept of switch mode power conversion is not new the technology to utilize it has only recently become available This outstanding monograph provides a complete overview of this subject enabling engineers to design and implement systems to meet specific requirements Using the simplest possible language for easy understanding Switch Mode Power Conversion offers such helpful features as a complete listing of calculator programs over 200 references and numerous graphical design aids presents examples of basic converter designs provides guidelines for avoiding input filter interaction with converter input impedance allows designers to check their work

with performance evaluation methods simplifies the explanation of magnetic components basics and much more With this timely volume the first single source reference in this field electrical and electronic engineers designers and manufacturers of electronic equipment and aerospace computer control and communication engineers will gain a full appreciation of Switch Mode Power Conversion

**Switch-Mode Power Converters** Keng C. Wu,2005-12-01 Switch Mode Power Converters introduces an innovative highly analytical approach to symbolic closed form solutions for switched mode power converter circuits This is a highly relevant topic to power electronics students and professionals who are involved in the design and analysis of electrical power converters The author uses extensive equations to explain how solid state switches convert electrical voltages from one level to another so that electronic devices e g audio speakers CD players DVD players etc can use different voltages more effectively to perform their various functions Most existing comparable books published as recently as 2002 do not discuss closed loop operations nor do they provide either DC closed loop regulation equations or AC loop gain stability formulae The author Wu a leading engineer at Lockheed Martin fills this gap and provides among the first descriptions of how error amplifiers are designed in conjunction with closed loop bandwidth selection **BENEFIT TO THE READER** Readers will gain a mathematically rigorous introduction to numerous closed form solutions that are readily applicable to the design and development of various switch mode power converters Provides symbolic closed form solutions for DC and AC studies Provides techniques for expressing close loop operation Gives readers the ability to perform closed loop regulation and sensitivity studies Gives readers the ability to design error amplifiers with precision Employs the concept of the continuity of states in matrix form Gives accelerated time domain steady state studies using Laplace transform Gives accelerated time domain studies using state transition Extensive use of matrix linear algebra implicit functions and Jacobian determinants Enables the determination of power stage gain that otherwise could not be obtained

**Switching Power Supplies A - Z** Sanjaya Maniktala,2006-06-22 The design of Switching Power Supplies has become one of the most crucial aspects of power electronics particularly in the explosive market for portable devices Unfortunately this seemingly simple mechanism is actually one of the most complex and under estimated processes in Power Electronics Switching power conversion involves several engineering disciplines Semiconductor Physics Thermal Management Control Loop theory Magnetics etc and all these come into play eventually in ways hard for non experts to grasp This book grows out of decades of the author s experience designing commercial power supplies Although his formal education was in physics he learned the hard way what it took to succeed in designing power supplies for companies like Siemens and National Semiconductor His passion for power supplies and his empathy for the practicing or aspiring power conversion engineer is evident on every page The most comprehensive study available of the theoretical and practical aspects of controlling and measuring Electromagnetic Interference in switching power supplies including input filter instability considerations Step by step and iterative approach for calculating high frequency losses in forward converter transformers including Proximity losses based

on Dowell's equations Thorough yet uniquely simple design flow chart for building DC DC converters and their magnetic components under typical wide input supply conditions Step by step solved examples for stabilizing control loops of all three major topologies using either transconductance or conventional operational amplifiers and either current mode or voltage mode control *Switch-mode Power Supply Design* P. R. K. Chetty,1986 [Switching Power Converters](#) Peter Wood,1981

**Power Electronics and Energy Conversion Systems, Fundamentals and Hard-switching Converters** Adrian Ioinovici,2013-04-02 *Power Electronics and Energy Conversion Systems* is a definitive five volume reference spanning classical theory through practical applications and consolidating the latest advancements in energy conversion technology Comprehensive yet highly accessible each volume is organised in a basic to sophisticated crescendo providing a single source reference for undergraduate and graduate students researchers and designers Volume 1 Fundamentals and Hard switching Converters introduces the key challenges in power electronics from basic components to operation principles and presents classical hard and soft switching DC to DC converters rectifiers and inverters At a more advanced level it provides comprehensive analysis of DC and AC models comparing the available approaches for their derivation and results A full treatment of DC to DC hard switching converters is given from fundamentals to modern industrial solutions and practical engineering insight The author elucidates various contradictions and misunderstandings in the literature for example in the treatment of the discontinuous conduction operation or in deriving AC small signal models of converters Other key features Consolidates the latest advancements in hard switching converters including discontinuous capacitor voltage mode and their use in power factor correction applications Includes fully worked design examples exercises and case studies with discussion of the practical consequences of each choice made during the design Explains all topics in detail with step by step derivation of formulas appropriate for energy conversion courses End of section review of the learned material Includes topics treated in recent journal conference and industry application coverage on solutions theory and practical concerns With emphasis on clear explanation the text offers both a thorough understanding of DC to DC converters for undergraduate and graduate students in power electronics and more detailed material suitable for researchers designers and practising engineers working on the development and design of power electronics This is an accessible reference for engineering and procurement managers from industries such as consumer electronics integrated circuits aerospace and renewable energy

**Switch Mode Power Supply Applications** Joe Marrero,Raymond Zhang,2020-07-07 This book is about how to analyze and design DC to DC converters by using both hand analysis and a wealth of Simulation so that the reader sees all the waveforms and understands what they mean Both DC and AC small signal hand and simulation are compared using average and switching models There are many tricks in quickly designing these DC to DC converters that are illustrated

*Switch-Mode Power Supplies Spice Simulations and Practical Designs* Christophe Basso,2008-02-06 *Harness Powerful SPICE Simulation and Design Tools to Develop Cutting Edge Switch Mode Power Supplies* *Switch Mode Power Supplies*

SPICE Simulations and Practical Designs is a comprehensive resource on using SPICE as a power conversion design companion. This book uniquely bridges analysis and market reality to teach the development and marketing of state-of-the-art switching converters. Invaluable to both the graduating student and the experienced design engineer, this guide explains how to derive founding equations of the most popular converters, design safe reliable converters through numerous practical examples, and utilize SPICE simulations to virtually breadboard a converter on the PC before using the soldering iron. Filled with more than 600 illustrations, Switch Mode Power Supplies: SPICE Simulations and Practical Designs enables you to derive founding equations of popular converters, understand and implement loop control via the book's exclusive small signal models, design safe reliable converters through practical examples, use SPICE simulations to virtually breadboard a converter on the PC, access design spreadsheets and simulation templates on the accompanying CD-ROM with numerous examples running on OrCAD ICAPS, CapTINA, and more. Inside This Powerful SPICE Simulation and Design Resource: Introduction to Power Conversion, Small Signal Modeling, Feedback and Control Loops, Basic Blocks and Generic Models, Simulation and Design of Nonisolated Converters, Simulation and Design of Isolated Converters, Front End Rectification and Power Factor Correction, Simulation and Design of Isolated Converters, The Flyback Simulation and Design of Isolated Converters, The Forward

**Soft-Switching Technology for Three-phase Power Electronics Converters** Dehong Xu, Rui Li, Ning He, Jinyi Deng, Yuying Wu, 2021-12-29. Soft Switching Technology for Three phase Power Electronics Converters. Discover foundational and advanced topics in soft switching technology including ZVS three phase conversion. In Soft Switching Technology for Three phase Power Electronics Converters, an expert team of researchers delivers a comprehensive exploration of soft switching three phase converters for applications including renewable energy and distribution power systems, AC power sources, UPS, motor drives, battery chargers, and more. The authors begin with an introduction to the fundamentals of the technology, providing the basic knowledge necessary for readers to understand the following articles. The book goes on to discuss three phase rectifiers and three phase grid inverters. It offers prototypes and experiments of each type of technology. Finally, the authors describe the impact of silicon carbide devices on soft switching three phase converters, studying the improvement in efficiency and power density created via the introduction of silicon carbide devices. Throughout, the authors put a special focus on a family of zero voltage switching (ZVS) three phase converters and related pulse width modulation (PWM) schemes. The book also includes a thorough introduction to soft switching techniques, including the classification of soft switching for three phase converter topologies, soft switching types, and a generic soft switching pulse width modulation known as Edge Aligned PWM. A comprehensive exploration of classical soft switching three phase converters, including the switching of power semiconductor devices and DC and AC side resonance. Practical discussions of ZVS space vector modulation for three phase converters, including the three phase converter commutation process. In depth examinations of three phase rectifiers with compound active clamping circuits. Perfect for researchers, scientists, professional engineers, and

undergraduate and graduate students studying or working in power electronics Soft Switching Technology for Three phase Power Electronics Converters is also a must read resource for research and development engineers involved with the design and development of power electronics     **Solutions Manual for Power-Switching Converters, Second Edition**  
Ang/Simon,Oliva/Alejandro,2005-05-01

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