

Volume II

Modeling, Analysis, and Design of PWM Converters

Edited by

Dr. Fred C. Lee

Virginia Power Electronics Center

TABLE OF CONTENTS

Forward.....	v
About the Book.....	vii
Part 1: Converter Modeling	
“Modeling and Analysis of Several Classes of Self-Oscillating Inverters,” <i>Part I: State Plane Representations,</i> F.C. Lee and T.G. Wilson (<i>IEEE Transactions on Circuits and Systems, June 1982</i>)	1
“Modeling and Analysis of Several Classes of Self-Oscillating Inverters, <i>Part II: Model Extension, Classification, and Duality Relationships,</i> F.C. Lee and T.G. Wilson, (<i>IEEE Transactions on Circuits and Systems, June 1982</i>).....	13
“Generalized Computer-Aided Discrete Time Domain Modeling and Analysis of DC/DC Converters,” F.C. Lee, R.P. Iwens, Y. Yu, and J.E. Triner, (<i>IEEE Transactions on Industrial Electronics and Control Instrumentations, May 1979</i>)	23
“Computer-Aided Analysis and Simulation of Switched DC/DC Converters,” F.C. Lee and Y. Yu, (<i>IEEE Transactions on Industrial Applications, September/October 1979</i>)	35
“An Improved Switching Converter Model Using Discrete and Average Techniques,” D.J. Shortt and F.C. Lee, (<i>IEEE Transactions on Aerospace and Electronic Systems, March 1983</i>)	45
“Extensions of the Discrete-Average Models for Converter Power Stages,” D.J. Shortt, and F.C. Lee, (<i>IEEE Transactions on Aerospace and Electronic Systems, May 1984</i>)	59
“Generation, Classification and Analysis of Switched-Mode DC-to-DC Converters by the Use of Converter Cells,” R. Tymerski and V. Vorperian, (<i>International Telecommunications Energy Conference, October 1986</i>).....	71
“Simplified Analysis of PWM Converters Using the Model of the PWM Switch, <i>Part I: Continuous Conduction Mode,</i> ” V. Vorperian, (<i>VPEC Seminar, September 1989</i>)	87
“Simplified Analysis of PWM Converters Using the Model of the PWM Switch, <i>Part II: Discontinuous Conduction Mode,</i> ” V. Vorperian, (<i>VPEC Seminar, September 1989</i>)	97
“Nonlinear Modeling of the PWM Switch,” R. Tymerski, V. Vorperian, F.C. Lee, and W. Baumann, (<i>IEEE Transactions on Power Electronics, April 1989</i>)	109
“A Set of CAD Tools for Electrical Design and Simulation of Switching Regulators,” S.S. Kelkar, R.B. Ridley, C.J. Hsiao, R. Ramkumar, and F.C. Lee (<i>VPEC Seminar, September 1987</i>)	119
“Circuit-Oriented Discrete-Time Modeling and Simulation for Switching Converters,” C. Hsiao, R.B. Ridley, H. Naitoh, and F.C. Lee, (<i>IEEE Power Electronics Specialists Conference and Exposition, June 1987</i>)	137
“The Simulation of Switching Converters Using the New Version COSMIR Program,” C.J. Hsiao, R.B. Ridley, and F.C. Lee, (<i>VPEC Seminar, September 1989</i>)	147

“Small-Signal Analysis of Switching DC-DC Converters Using the Simulation Program COSMIR,” C.J. Hsiao, R.B. Ridley, and F.C. Lee, (VPEC Seminar, September 1988).....	157
“Small-Signal Analysis of Systems with Periodic Operating Trajectories,” J.O. Groves and F.C. Lee, (VPEC Seminar, September 1988).....	165
“Topological Constraints on Basic PWM Converters,” K.H. Liu and F.C. Lee, (IEEE Power Electronics Specialists Conference and Exposition, April 1988)	175
“Average Small-Signal Analysis of the Boost Power Factor Correction Circuit,” R.B. Ridley, (VPEC Seminar, September 1989).....	185

Part 2: Control

“A Unified Analysis and Design Procedure for a Standardized Control Module for DC-DC Switching Regulators,” F.C. Lee, Y. Yu, and M.F. Mahmoud, (IEEE Power Electronics Specialists Conference and Exposition, June 1980).....	199
“An Adaptive-Control Switching Buck Regulator – Implementation, Analysis and Design,” F.C. Lee and Y. Yu, (IEEE Transactions on Aerospace and Electronic Systems, January 1980)	217
“Investigations of Stability and Dynamic Performances of Switching Regulators Employing Current-Injected Control,” F.C. Lee and R.A. Carter, (IEEE Transactions on Aerospace and Electronic Systems, March 1983)	233
“Optimal Design Strategy of Switching Converters Employing Current Injected Control,” F.C. Lee, Z.D. Fang, and T.H. Lee, (IEEE Transactions on Aerospace and Electronic Systems, January 1985)	247
“A Novel Input Filter Compensation Scheme for Switching Regulators,” S.S. Kelkar and F.C. Lee, (IEEE Transactions on Aerospace and Electronics Systems, March 1983).....	263
“Adaptive Input Filter Compensation for Switching Regulators,” S.S. Kelkar and F.C. Lee, (IEEE Transactions on Aerospace and Electronic Systems, March 1983).....	275
“Measurement of Loop Gain with the Digital Modulator,” B.H. Cho and F.C. Lee, (IEEE Transaction on Power Electronics, January 1986)	285
“Secondary LC Filter Analysis and Design Techniques for Current-Mode-Controlled Converters,” R.B. Ridley, (IEEE Transactions on Power Electronics, October 1988).....	293
“A Simple Model Predicts Small-Signal Control Loop Behavior of Magamp Post Regulator,” D.Y. Chen, J. Lee, and C. Jamerson, (High Frequency Power Conversion Conference, May 1988).....	301
“Magamp Post Regulators – Practical Design Considerations to Allow Operation Under Extreme Loading Conditions,” J. Lee, D.Y. Chen, and C. Jamerson (IEEE Applied Power Electronics Conference and Exposition, February 1989).....	311
“A New, Continuous-Time Model for Current-Mode Control,” R.B. Ridley, (Power Conversion and Intelligent Motion Conference, October 1989)	321
“A New Continuous-Time Model for Current-Mode Control with Constant Frequency, Constant On-Time, and Constant Off-Time in CCM and DCM,” R.B. Ridley, (Power Electronics Specialists Conference, June 199)	333

“Design and Analysis of a Hysteric Boost Power Factor Correction Circuit,” C. Zhou, R.B. Ridley, and F.C. Lee, (<i>Power Electronics Specialists Conference, June 1990</i>).....	341
“Elimination of the Positive Zero in Fixed Frequency Boost and Flyback Converters,” D.M. Sable, B.H. Cho, and R.B. Ridley, (<i>Applied Power Electronics Conference, March 1990</i>)	349
“Comparison of Performance of Single-Loop and Current-Injection-Control for PWM Converters Which Operate in Both Continuous and Discontinuous Modes of Operation,” D.M. Sable, R. B. Ridley, and B.H. Cho, (<i>Power Electronics Specialists Conference, June 1990</i>).....	357

Part 3: Design Optimization

“Algorithms for Power Converter Design Optimization,” S. Balachandran and F.C. Lee, (<i>IEEE Transactions on Aerospace and Electronic Systems, May 1981</i>)	363
“Comparisons of Nonlinearly Constrained Optimization Algorithms for Power Converter Design,” F.C. Lee and S. Balachandran, (<i>Applied Modeling and Simulation Conference 1981</i>)	375
“Nonlinear Program Based Optimization of Boost and Buck-Boost Converter Designs,” S. Rahman and F. C. Lee, (<i>IEEE Transactions on Aerospace and Electronics Systems, September 1982</i>).....	381
“Design Optimization for a Half-Bridge DC-DC Converter,” C.J. Wu, F.C. Lee, S. Balachandran, and H.L. Goin, (<i>IEEE Transactions on Aerospace and Electronic Systems, July 1982</i>).....	393
“Practical Nonlinear Design Optimization Tool for Power Converter Components” R.B. Ridley and F.C. Lee, (<i>IEEE Power Electronics Specialists Conference and Exposition, June 1987</i>)	405
“Design and Analysis of an Active Unity Power Power Factor Correction Circuit,” C. Zhou, R.B. Ridley, and F.C. Lee, (<i>VPEC Seminar, September 1989</i>)	415
“Use of Nonlinear Design Optimization Techniques in the Comparison of Battery Discharger Topologies for the Space Platform,” D.M. Sable, B.H. Cho, and F.C. Lee, (<i>Intersociety Energy Conversion Engineering Conference, August 1990</i>).....	425
“Control Strategy for Multi-Module Parallel Converter System,” B. Choi, B.H. Cho, R.B. Ridley, and F.C. Lee, (<i>Power Electronics Specialists Conference, June 1990</i>).....	433

Part 4: System Modeling

“Modeling and Analysis of Spacecraft Power Systems,” B.H. Cho and F.C. Lee, (<i>IEEE Transactions on Power Electronics, January 1988</i>)	443
“Modeling and Simulation of Spacecraft Power Systems,” J.R. Lee, B.H. Cho, S.J. Kim, and F.C. Lee, (<i>IEEE Transactions on Aerospace and Electronic Systems, May 1988</i>).....	455
“Large-Signal Stability Analysis of Spacecraft Power Processing Systems,” B.H. Cho, J.R. Lee, and F.C. Lee, (<i>IEEE Power Electronics Specialists Conference and Exposition, June 1987</i>).....	463
“Design, Analysis and Simulation of the Main Bus Dynamics of Spacecraft Power Systems,” B.H. Cho and J.R. Lee, (<i>Intersociety Energy Conversion Engineering Conference, July 1988</i>).....	469

“A High Frequency, Multi-Module Spacecraft Boost Regulator,” <i>D.M. Sable and R.B. Ridley, (VPEC Seminar, September 1988)</i>	479
“Computer Modeling and Simulation of a 20 kHz AC Distribution System for Space Station,” <i>F.S. Tsai and F. C. Lee, (Intersociety Energy Conversion Engineering Conference, August 1987)</i>	489
“Modeling and Simulation of a Space Station Power System,” <i>J.R. Lee, F.S. Tsai, S.J. Kim, A. Patil, B.H. Cho, and F.C. Lee, (VPEC Seminar, September 1989)</i>	497
“Modeling and Analysis of Distributed Power Systems,” <i>L. R. Lewis, B.H. Cho, F.C. Lee, and B.A. Carpenter, (IEEE Power Electronics Specialists Conference and Exposition, June 1989)</i>	505
“Design Considerations for Distributed Power Systems,” <i>. Liu, S. Schulz, B.H. Cho, and F.C. Lee, (VPEC Seminar, September 1989)</i>	515
“Large-Signal Modeling and Simulation of Distributed Power Systems,” <i>S. Schulz, J. Liu, B.H. Cho, and F.C. Lee, (VPEC Seminar, September 1989)</i>	523
“Design Considerations for a Solar Array Switching Unit,” <i>A.R. Patil, B.H. Cho, and F.C. Lee, (Intersociety Energy Conversion Engineering Conference, August 1990)</i>	529
“Modeling and Simulation of the Space Platform Power System,” <i>A.R. Patil, S.J. Kim, B.H. Cho, and F.C. Lee, (Intersociety Energy Conversion Engineering Conference, August 1990)</i>	537
“Design Considerations for a Distributed Power System,” <i>S. Schulz, B.H. Cho, and F.C. Lee, (Power Electronics Specialists Conference, June 1990)</i>	545
Author Index	553
Editors’ Biographies	555