Pulse-width Modulated DC-DC Power Converters

Description: This book studies switch-mode power supplies (SMPS) in great detail. This type of converter changes an unregulated DC voltage into a high-frequency pulse-width modulated (PWM) voltage controlled by varying the duty cycle, then changes the PWM AC voltage to a regulated DC voltage at a high efficiency by rectification and filtering. Used to supply electronic circuits, this converter saves energy and space in the overall system.

With concept-orientated explanations, this book offers state-of-the-art SMPS technology and promotes an understanding of the principle operations of PWM converters, as well as enabling the readers to evaluate their characteristics. Design-orientated analysis (including a steady-state analysis for both continuous and discontinuous conduction modes) and numerous real-world practical examples (including circuit models of the PWM converters) demonstrate how to design these from scratch.

The book provides an in-depth presentation of topologies of PWM DC-DC power converters, voltage- and current-mode control of PWM DC–DC power converters, considers power losses in all components, device stresses, output voltage ripple, converter efficiency and power factor correction (PFC). It also includes extensive coverage of the following:

- topologies of high-efficiency switching-mode PWM and soft-switching DC-DC power converters;
- DC voltage transfer functions (conversion ratios), component values, losses, efficiency, and stresses;
- small-signal averaged circuit models;
- current-mode and voltage-mode feedback controls;
- metal-oxide-semiconductor field-effect power transistors (MOSFETs);
- silicon (Si) and silicon carbide (SiC) power semiconductor devices. Before now, there has been no book that covers silicon carbide devices.

Pulse-width Modulated DC-DC Power Converters is a comprehensive textbook for senior undergraduate and graduate students in the areas of electrical, electronics, and telecommunications engineering. It includes end-of-chapter review questions, problems, and thorough summaries of the key concepts to aid learning, and a Solutions Manual is available for professors. Scientists and practicing design engineers working with SMPS, within such applications as computers, telecommunications, industrial systems, automobile electronics, medical equipment, aerospace power technology, and radars (amongst others) will also find this text insightful.

Contents: Preface.

About the Author.

List of Symbols.

1 Introduction.

1.1 Classification of Power Supplies.

1.2 Basic Functions of Voltage Regulators.

1.3 Power Relationships in DC–DC Converters.

1.4 DC Transfer Functions of DC–DC Converters.

1.5 Static Characteristics of DC Voltage Regulators.

1.6 Dynamic Characteristics of DC Voltage Regulators.

1.7 Linear Voltage Regulators.
3.11 Problems.

4 Buck-Boost PWM DC–DC Converter.

4.1 Introduction.

4.2 DC Analysis of PWM Buck-Boost Converter for CCM.

4.3 DC Analysis of PWM Buck-Boost Converter for DCM.

4.4 Bidirectional Buck-Boost Converter.

4.5 Synthesis of Buck-Boost Converter.

4.6 Synthesis of Boost-Buck (Cuk) Converter.

4.7 Noninverting Buck-Boost Converters.

4.8 Tapped-Inductor Buck-Boost Converters.

4.9 Summary.

4.10 References.

4.11 Review Questions.

4.12 Problems.

5 Flyback PWM DC–DC Converter.

5.1 Introduction.

5.2 Transformers.

5.3 DC Analysis of PWM Flyback Converter for CCM.

5.4 DC Analysis of PWM Flyback Converter for DCM.

5.5 Multiple-Output Flyback Converter.

5.6 Bidirectional Flyback Converter.

5.7 Ringing in Flyback Converter.

5.8 Flyback Converter with Active Clamping.

5.9 Two-Transistor Flyback Converter.

5.10 Summary.

5.11 References.

5.12 Review Questions.

5.13 Problems.

6 Forward PWM DC–DC Converter.

6.1 Introduction.

6.2 DC Analysis of PWM Forward Converter for CCM.

6.3 DC Analysis of PWM Forward Converter for DCM.
6.4 Multiple-Output Forward Converter.
6.5 Forward Converter with Synchronous Rectifier.
6.6 Forward Converters with Active Clamping.
6.7 Two-Switch Forward Converter.
6.8 Summary.
6.9 References.
6.10 Review Questions.
6.11 Problems.
7 Half-Bridge PWM DC–DC Converter.
7.1 Introduction.
7.2 DC Analysis of PWM Half-Bridge Converter for CCM.
7.3 DC Analysis of PWM Half-Bridge Converter for DCM.
7.4 Summary.
7.5 References.
7.6 Review Questions.
7.7 Problems.
8 Full-Bridge PWM DC–DC Converter.
8.1 Introduction.
8.2 DC Analysis of PWM Full-Bridge Converter for CCM.
8.3 DC Analysis of PWM Full-Bridge Converter for DCM.
8.4 Phase-Controlled Full-Bridge Converter.
8.5 Summary.
8.6 References.
8.7 Review Questions.
8.8 Problems.
9 Push-Pull PWM DC–DC Converter.
9.1 Introduction.
9.2 DC Analysis of PWM Push-Pull Converter for CCM.
9.3 DC Analysis of PWM Push-Pull Converter for DCM.
9.4 Comparison of PWM DC–DC Converters.
9.5 Summary.
9.6 References.
9.7 Review Questions.
9.8 Problems.

10 Small-Signal Models of PWM Converters for CCM and DCM.
10.1 Introduction.
10.2 Assumptions.
10.3 Averaged Model of Ideal Switching Network for CCM.
10.4 Averaged Values of Switched Resistances.
10.5 Model Reduction.
10.6 Large-Signal Averaged Model for CCM.
10.7 DC and Small-Signal Circuit Linear Models of Switching Network for CCM.
10.8 Family of PWM Converter Models for CCM.
10.9 PWM Small-Signal Switch Model for CCM.
10.10 Modeling of the Ideal Switching Network for DCM.
10.11 Averaged Parasitic Resistances for DCM.
10.12 Small-Signal Models of PWM Converters for DCM.
10.13 Summary.
10.14 References.
10.15 Review Questions.
10.16 Problems.

11 Open-Loop Small-Signal Characteristics of Boost Converter for CCM.
11.1 Introduction.
11.2 DC Characteristics.
11.3 Open-Loop Control-to-Output Transfer Function.
11.4 Delay in Open-Loop Control-to-Output Transfer Function.
11.5 Open-Loop Audio Susceptibility.
11.6 Open-Loop Input Impedance.
11.7 Open-Loop Output Impedance.
11.8 Open-Loop Step Responses.
11.9 Summary.
11.10 References.
11.11 Review Questions.
11.12 Problems.

12 Voltage-Mode Control of Boost Converter.

12.1 Introduction.

12.2 Circuit of Boost Converter with Voltage-Mode Control.

12.3 Pulse-Width Modulator.

12.4 Transfer Function of Modulator, Boost Converter Power Stage, and Feedback Network.

12.5 Error Amplifier.

12.6 Integral-Single-Lead Controller.

12.7 Integral-Double-Lead Controller.

12.8 Loop Gain.

12.9 Closed-Loop Control-to-Output Voltage Transfer Function.

12.10 Closed-Loop Audio Susceptibility.

12.11 Closed-Loop Input Impedance.

12.12 Closed-Loop Output Impedance.

12.13 Closed-Loop Step Responses.

12.14 Closed-Loop DC Transfer Functions.

12.15 Summary.

12.16 References.

12.17 Review Questions.

12.18 Problems.

13 Current-Mode Control.

13.1 Introduction.


13.3 Relationship between Duty Cycle and Inductor-Current Slopes.

13.4 Instability of Closed-Current Loop.

13.5 Slope Compensation.

13.6 Sample-and-Hold Effect on Current Loop.

13.7 Current Loop in s-Domain.

13.8 Voltage Loop of PWM Converters with Current-Mode Control.

13.9 Feedforward Gains in PWM Converters with Current-Mode Control without Slope Compensation.

13.10 Feedforward Gains in PWM Converters with Current-Mode Control and Slope Compensation.
16 Silicon and Silicon Carbide Power MOSFETs.

16.1 Introduction.

16.2 Physical Structure of Power MOSFETs.

16.3 Principle of Operation of Power MOSFETs.

16.4 Derivation of Power MOSFET Characteristics.

16.5 Power MOSFET Characteristics.

16.6 Mobility of Charge Carriers.

16.7 Short-Channel Effects.

16.8 Aspect Ratio of Power MOSFETs.

16.9 Breakdown Voltage of Power MOSFETs.

16.10 Gate Oxide Breakdown Voltage of Power MOSFETs.

16.11 Resistance of Drift Region.

16.12 Figures-of-Merit.

16.13 On-Resistance of Power MOSFETs.

16.14 Capacitances of Power MOSFETs.

16.15 Switching Waveforms.

16.16 SPICE Model of Power MOSFETs.

16.17 Insulated Gate Bipolar Transistors.

16.18 Heat Sinks.

16.19 Summary.

16.20 References.

16.21 Review Questions.

16.22 Problems.

17 Soft-Switching DC–DC Converters.

17.1 Introduction.

17.2 Zero-Voltage-Switching DC–DC Converters.

17.3 Buck ZVS Quasi-Resonant DC–DC Converter.
17.4 Boost ZVS Quasi-Resonant DC–DC Converter.
17.5 Zero-Current-Switching DC–DC Converters.
17.6 Boost ZCS Quasi-Resonant DC–DC Converter.
17.7 Multiresonant Converters.
17.8 Summary.
17.9 References.
17.10 Review Questions.
17.11 Problems.

Appendix A Introduction to SPICE.
Appendix B Introduction to MATLAB.

Answers to Problems.

Index.


Order by Fax - using the form below

Order by Post - print the order form below and send to

Research and Markets,
Guinness Centre,
Taylors Lane,
Dublin 8,
Ireland.
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct.

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>Pulse-width Modulated DC-DC Power Converters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Address:</td>
<td><a href="http://www.researchandmarkets.com/reports/2326330/">http://www.researchandmarkets.com/reports/2326330/</a></td>
</tr>
<tr>
<td>Office Code:</td>
<td>SCAYNBKS</td>
</tr>
</tbody>
</table>

Product Format
Please select the product format and quantity you require:

<table>
<thead>
<tr>
<th>Hard Copy (Hard Back)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USD 159 + USD 28 Shipping/Handling</td>
</tr>
</tbody>
</table>

* Shipping/Handling is only charged once per order.

Contact Information
Please enter all the information below in BLOCK CAPITALS

<table>
<thead>
<tr>
<th>Title:</th>
<th>Mr</th>
<th>Mrs</th>
<th>Dr</th>
<th>Miss</th>
<th>Ms</th>
<th>Prof</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last Name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email Address: *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Title:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postal / Zip Code:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Number:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:
Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:
Account number 833 130 83
Sort code 98-53-30
Swift code ULSBIE2D
IBAN number IE78ULSB98533083313083
Bank Address Ulster Bank,
27-35 Main Street,
Blackrock,
Co. Dublin,
Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: ________________________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World