Resonant Power Converters. 2nd Edition

Description: This book is devoted to resonant energy conversion in power electronics. It is a practical, systematic guide to the analysis and design of various dc-dc resonant inverters, high-frequency rectifiers, and dc-dc resonant converters that are building blocks of many of today's high-frequency energy processors. Designed to function as both a superior senior-to-graduate level textbook for electrical engineering courses and a valuable professional reference for practicing engineers, it provides students and engineers with a solid grasp of existing high-frequency technology, while acquainting them with a number of easy-to-use tools for the analysis and design of resonant power circuits. Resonant power conversion technology is now a very hot area and in the center of the renewable energy and energy harvesting technologies.

Contents:

PREFACE xxi
ABOUT THE AUTHORS xxv
LIST OF SYMBOLS xxvii

I Introduction 1
1.1 References 5

PART I RECTIFIERS 7
2 Class D Current-Driven Rectifiers 9
2.1 Introduction 9
2.2 Assumptions 10
2.3 Class D Half-Wave Rectifier 10
2.4 Class D Transformer Center-Tapped Rectifier 20
2.5 Class D Bridge Rectifier 28
2.6 Effects of Equivalent Series Resistance and Equivalent Series Inductance 34
2.7 Synchronous Rectifiers 38

3 Class D Voltage-Driven Rectifiers 47
3.1 Introduction 47
3.2 Assumptions 47
3.3 Class D Half-Wave Rectifier 48
3.4 Class D Transformer Center-Tapped Rectifier 56
3.5 Class D Bridge Rectifier 62
3.6 Synchronous Rectifiers 66

4 Class E Low dv/dt Rectifiers 72
4.1 Introduction 72
4.2 Low dv/dt Rectifier with a Parallel Capacitor 72
4.3 Resonant Low dv/dt Rectifier 90
5 Class E Low di/dt Rectifiers 109
5.1 Introduction 109
5.2 Low di/dt Rectifier with a Parallel Inductor 109
5.3 Low di/dt Rectifier with a Series Inductor 125

PART II INVERTERS 141
6 Class D Series-Resonant Inverter 143
6.1 Introduction 143
6.2 Circuit Description 144
6.3 Principle of Operation 146
6.4 Topologies of Class D Voltage-Source Inverters 152
6.5 Analysis 155
6.6 Voltage Transfer Function 166
6.7 Efficiency 170
6.8 Design Example 177
6.9 Class D Full-Bridge Series-Resonant Inverter 180
6.10 Relationships Among Inverters and Rectifiers 187
7 Class D Parallel-Resonant Inverter 193
7.1 Introduction 193
7.2 Principle of Operation 193
7.3 Analysis 197
7.4 Short-Circuit and Open-Circuit Operation 219
7.5 Electronic Ballast for Fluorescent Lamps 223
7.6 Design Example 225
7.7 Full-Bridge Parallel-Resonant Inverter 227
8 Class D Series-Parallel-Resonant Inverter 235
8.1 Introduction 235
8.2 Principle of Operation 235
8.3 Analysis 237
8.4 Design Example 254
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.4 Analysis</td>
<td>373</td>
</tr>
<tr>
<td>13.5 Power Relationships</td>
<td>378</td>
</tr>
<tr>
<td>13.6 Element Values of Load Network</td>
<td>378</td>
</tr>
<tr>
<td>13.7 Design Example</td>
<td>379</td>
</tr>
<tr>
<td>14 Class DE Power Inverter</td>
<td>382</td>
</tr>
<tr>
<td>14.1 Introduction</td>
<td>382</td>
</tr>
<tr>
<td>14.2 Principle of Operation of Class DE Power Inverter</td>
<td>382</td>
</tr>
<tr>
<td>14.3 Analysis of Class DE Power Inverter</td>
<td>383</td>
</tr>
<tr>
<td>14.4 Components</td>
<td>393</td>
</tr>
<tr>
<td>14.5 Device Stresses</td>
<td>394</td>
</tr>
<tr>
<td>14.6 Design Equations</td>
<td>395</td>
</tr>
<tr>
<td>14.7 Maximum Operating Frequency</td>
<td>395</td>
</tr>
<tr>
<td>14.8 Class DE Inverter with Single Shunt Capacitor</td>
<td>397</td>
</tr>
<tr>
<td>14.9 Output Power</td>
<td>401</td>
</tr>
<tr>
<td>14.10 Cancellation of Nonlinearities of Transistor Output Capacitances</td>
<td>401</td>
</tr>
<tr>
<td>PART III CONVERTERS</td>
<td>405</td>
</tr>
<tr>
<td>15 Class D Series-Resonant Converter</td>
<td>407</td>
</tr>
<tr>
<td>15.1 Introduction</td>
<td>407</td>
</tr>
<tr>
<td>15.2 Half-Bridge Series-Resonant Converter</td>
<td>408</td>
</tr>
<tr>
<td>15.3 Full-Bridge Series-Resonant Converter</td>
<td>412</td>
</tr>
<tr>
<td>15.4 Design of Half-Bridge SRC</td>
<td>415</td>
</tr>
<tr>
<td>16 Class D Parallel-Resonant Converter</td>
<td>422</td>
</tr>
<tr>
<td>16.1 Introduction</td>
<td>422</td>
</tr>
<tr>
<td>16.2 Half-Bridge Parallel-Resonant Converter</td>
<td>422</td>
</tr>
<tr>
<td>16.3 Design of the Half-Bridge PRC</td>
<td>427</td>
</tr>
<tr>
<td>16.4 Full-Bridge Parallel-Resonant Converter</td>
<td>430</td>
</tr>
<tr>
<td>17 Class D Series-Parallel-Resonant Converter</td>
<td>435</td>
</tr>
<tr>
<td>17.1 Introduction</td>
<td>435</td>
</tr>
<tr>
<td>17.2 Circuit Description</td>
<td>436</td>
</tr>
<tr>
<td>17.3 Half-Bridge Series-Parallel-Resonant Converter</td>
<td>439</td>
</tr>
<tr>
<td>17.4 Design of Half-Bridge SPRC</td>
<td>440</td>
</tr>
</tbody>
</table>
17.5 Full-Bridge Series-Parallel-Resonant Converter 443
18 Class D CLL Resonant Converter 448
18.1 Introduction 448
18.2 Circuit Description 448
18.3 Half-Bridge CLL Resonant Converter 451
18.4 Design of Half-Bridge CLL Resonant Converter 453
18.5 Full-Bridge CLL Resonant Converter 455
18.6 LLC Resonant Converter 457
19 Class D Current-Source-Resonant Converter 459
19.1 Introduction 459
19.2 Circuit Description 459
19.3 Design of CSRC 461
20 Class D Inverter/Class E Rectifier Resonant Converter 466
20.1 Introduction 466
20.2 Circuit Description 466
20.3 Principle of Operation 468
20.4 Rectifier Parameters for D=0.5 469
20.5 Design of Class D Inverter/Class E Resonant Converter 471
20.6 Class E ZVS Inverter/Class D Rectifier Resonant DC-DC Converter 473
20.7 Class E ZVS Inverter/Class E ZVS Rectifier Resonant DC-DC Converter 474
21 Phase-Controlled Resonant Converters 477
21.1 Introduction 477
21.2 Circuit Description of SC PC SRC 477
21.3 Design Example 480
22 Quasiresonant and Multiresonant DC-DC Power Converters 485
22.1 Introduction 485
22.2 Zero-Voltage-Switching Quasiresonant DC-DC Converters 488
22.3 Buck ZVS Quasiresonant DC-DC Converter 492
22.4 Boost ZVS Quasiresonant DC-DC Converter 501
22.5 Buck-Boost ZVS Quasiresonant DC-DC Converter 509
22.6 Zero-Current-Switching Quasiresonant DC-DC Converters 518
22.7 Buck ZCS Quasiresonant DC-DC Converter 520
22.8 Boost ZCS Quasiresonant DC-DC Converter 529
22.9 Buck-Boost ZCS Quasiresonant DC-DC Converter 536
22.10 Zero-Voltage Switching Multiwsonant DC-DC Converters 545
22.11 Zero-Current Switching Multiwsonant DC-DC Converters 550
22.12 Zero-Voltage Transition PWM Converters 553
22.13 Zero-Current Transition Converters 556
23 Modeling and Control 565
23.1 Introduction 565
23.2 Modeling 566
23.3 Model Reduction and Control 572
23.4 Summary 574
23.5 References 574
23.6 Review Questions 576
23.7 Problems 576
APPENDICES 577
ANSWERS TO PROBLEMS 591
INDEX 597

Ordering: Order Online - http://www.researchandmarkets.com/reports/2172225/
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.

Product Name: Resonant Power Converters. 2nd Edition
Web Address: http://www.researchandmarkets.com/reports/2172225/
Office Code: SCAYPEB7

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

<table>
<thead>
<tr>
<th>Quantity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Copy (Hard Back)</td>
<td>USD 157 + 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

Title: Mr [ ] Mrs [ ] Dr [ ] Miss [ ] Ms [ ] Prof [ ]
First Name: ___________________________ Last Name: ___________________________
Email Address: * ___________________________
Job Title: ___________________________
Organisation: ___________________________
Address: ___________________________
City: ___________________________
Postal / Zip Code: ___________________________
Country: ___________________________
Phone Number: ___________________________
Fax Number: ___________________________

* 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:

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account number</td>
<td>833 130 83</td>
</tr>
<tr>
<td>Sort code</td>
<td>98-53-30</td>
</tr>
<tr>
<td>Swift code</td>
<td>ULSBIE2D</td>
</tr>
<tr>
<td>IBAN number</td>
<td>IE78ULSB98533083313083</td>
</tr>
</tbody>
</table>
| 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