Superconductivity. An Introduction. 3rd Edition

Description: The third edition of this proven text has been developed further in both scope and scale to reflect the potential for superconductivity in power engineering to increase efficiency in electricity transmission or engines.

The landmark reference remains a comprehensive introduction to the field, covering every aspect from fundamentals to applications, and presenting the latest developments in organic superconductors, superconducting interfaces, quantum coherence, and applications in medicine and industry.

Due to its precise language and numerous explanatory illustrations, it is suitable as an introductory textbook, with the level rising smoothly from chapter to chapter, such that readers can build on their newly acquired knowledge.

The authors cover basic properties of superconductors and discuss stability and different material groups with reference to the latest and most promising applications, devoting the last third of the book to applications in power engineering, medicine, and low temperature physics. An extensive list of more than 350 references provides an overview of the most important publications on the topic.

A unique and essential guide for students in physics and engineering, as well as a reference for more advanced researchers and young professionals.

Contents:

Preface to the Third Edition IX

Introduction 1

References 9

1 Fundamental Properties of Superconductors 11

1.1 The Vanishing of the Electrical Resistance 11

1.2 Ideal Diamagnetism, Flux Lines, and Flux Quantization 21

1.3 Flux Quantization in a Superconducting Ring 30

1.4 Superconductivity: A Macroscopic Quantum Phenomenon 33

1.5 Quantum Interference 45

1.5.1 Josephson Currents 47

1.5.2 Quantum Interference in a Magnetic Field 59

References 71

2 Superconducting Elements, Alloys, and Compounds 75

2.1 Introductory Remarks 75

2.1.1 Discovery, Preparation, and Characterization of New Superconductors 75

2.1.2 Conventional and Unconventional Superconductors 76

2.2 Superconducting Elements 78
4.1 General Aspects of Thermodynamics 201
4.2 Specific Heat 205
4.3 Thermal Conductivity 209
4.4 Ginzburg–Landau Theory 212
4.5 Characteristic Lengths of the Ginzburg–Landau Theory 216
4.6 Type–I Superconductors in a Magnetic Field 221
4.6.1 Critical Field and Magnetization of Rod–Shaped Samples 221
4.6.2 Thermodynamics of the Meissner State 226
4.6.3 Critical Magnetic Field of Thin Films in a Field Parallel to the Surface 230
4.6.4 The Intermediate State 231
4.6.5 The Wall Energy 235
4.6.6 Influence of Pressure on the Superconducting State 239
4.7 Type–II Superconductors in a Magnetic Field 244
4.7.1 Magnetization Curve and Critical Fields 246
4.7.2 The Shubnikov Phase 256
4.8 Fluctuations above the Transition Temperature 268
4.9 States Outside Thermodynamic Equilibrium 272
References 277

5 Critical Currents in Type–I and Type–II Superconductors 283
5.1 Limit of the Supercurrent Due to Pair Breaking 283
5.2 Type–I Superconductors 285
5.3 Type–II Superconductors 291
5.3.1 Ideal Type–II Superconductor 291
5.3.2 Hard Superconductors 296
5.3.2.1 Pinning of Flux Lines 296
5.3.2.2 Magnetization Curve of Hard Superconductors 301
5.3.2.3 Critical Currents and Current Voltage Characteristics 310
References 318

6 Josephson Junctions and Their Properties 321
6.1 Current Transport across Interfaces in a Superconductor 321
6.1.1 Superconductor–Insulator Interface 321
6.1.2 Superconductor Normal Conductor Interfaces 328
6.1.3 Superconductor Ferromagnet Interfaces 335
6.2 The RCSJ Model 337
6.3 Josephson Junctions under Microwave Irradiation 342
6.4 Vortices in Long Josephson Junctions 346
6.5 Quantum Properties of Superconducting Tunnel Junctions 357
6.5.1 Coulomb Blockade and Single-Electron Tunneling 358
6.5.2 Flux Quanta and Macroscopic Quantum Coherence 363
References 368
7 Applications of Superconductivity 373
7.1 Superconducting Magnetic Coils 374
7.1.1 General Aspects 374
7.1.2 Superconducting Cables and Tapes 375
7.1.3 Coil Protection 386
7.2 Superconducting Permanent Magnets 388
7.3 Applications of Superconducting Magnets 390
7.3.1 Nuclear Magnetic Resonance 390
7.3.2 Magnetic Resonance Imaging 394
7.3.3 Particle Accelerators 395
7.3.4 Nuclear Fusion 397
7.3.5 Energy Storage Devices 398
7.3.6 Motors and Generators 401
7.3.7 Magnetic Separation and Induction Heaters 404
7.3.8 Levitated Trains 405
7.4 Superconductors for Power Transmission: Cables, Transformers, and Current Fault Limiters 406
7.4.1 Superconducting Cables 407
7.4.2 Transformers 409
7.4.3 Current Fault Limiters 411
7.5 Superconducting Resonators and Filters 412
7.5.1 High-Frequency Behavior of Superconductors 413
7.5.2 Resonators for Particle Accelerators 417
7.5.3 Resonators and Filters for Communications Technology 420
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: Superconductivity. An Introduction. 3rd Edition
Web Address: http://www.researchandmarkets.com/reports/3089787/
Office Code: SCH3BVZY

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

<table>
<thead>
<tr>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Copy (Paper back):</td>
</tr>
<tr>
<td>USD 99 + USD 29 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: ___________________________
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>Account number</th>
<th>833 130 83</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>Bank Address</td>
<td>Ulster Bank, 27-35 Main Street, Blackrock, Co. Dublin, Ireland.</td>
</tr>
</tbody>
</table>

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