

教育部高等教育司推荐
国外优秀信息科学与技术系列教学用书

电路分析基础

第九版 影印版

Introductory Circuit Analysis

9th Edition

■ Boylestad



高等教育出版社
Higher Education Press



Prentice Hall

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前 言

20 世纪末, 以计算机和通信技术为代表的信息科学和技术对世界经济、科技、军事、教育和文化等产生了深刻影响。信息科学技术的迅速普及和应用, 带动了世界范围信息产业的蓬勃发展, 为许多国家带来了丰厚的回报。

进入 21 世纪, 尤其随着我国加入 WTO, 信息产业的国际竞争将更加激烈。我国信息产业虽然在 20 世纪末取得了迅猛发展, 但与发达国家相比, 甚至与印度、爱尔兰等国家相比, 还有很大差距。国家信息化的发展速度和信息产业的国际竞争能力, 最终都将取决于信息科学技术人才的质量和数量。引进国外信息科学和技术优秀教材, 在有条件的学校推动开展英语授课或双语教学, 是教育部为加快培养大批高质量的信息技术人才采取的一项重要举措。

为此, 教育部要求由高等教育出版社首先开展信息科学和技术教材的引进试点工作。同时提出了两点要求, 一是要高水平, 二是要低价格。在高等教育出版社和信息科学技术引进教材专家组的努力下, 经过比较短的时间, 第一批引进的 20 多种教材已经陆续出版。这套教材出版后受到了广泛的好评, 其中有不少是世界信息科学技术领域著名专家、教授的经典之作和反映信息科学技术最新进展的优秀作品, 代表了目前世界信息科学技术教育的一流水平, 而且价格也是最优惠的, 与国内同类自编教材相当。

这项教材引进工作是在教育部高等教育司和高教社的共同组织下, 由国内信息科学技术领域的专家、教授广泛参与, 在对大量国外教材进行多次遴选的基础上, 参考了国内和国外著名大学相关专业的课程设置进行系统引进的。其中, John Wiley 公司出版的贝尔实验室信息科学研究中心副总裁 Silberschatz 教授的经典著作《操作系统概念》, 是我们经过反复谈判, 做了很多努力才得以引进的。William Stallings 先生曾编写了在美国深受欢迎的信息科学技术系列教材, 其中有多种教材获得过美国教材和学术著作者协会颁发的计算机科学与工程教材奖, 这批引进教材中就有他的两本著作。留美中国学者 Jiawei Han 先生的《数据挖掘》是该领域中具有里程碑意义的著作。由达特茅斯学院的 Thomas Cormen 和麻省理工学院、哥伦比亚大学几位学者共同编著的经典著作《算法导论》, 在经历了 11 年的锤炼之后于 2001 年出版了第二版。目前任教于美国 Massachusetts 大学的 James Kurose 教授, 曾在美国三所高校先后 10 次获得杰出教师或杰出教学奖, 由他主编的《计算机网络》出版后, 以其体系新颖、内容先进而倍受欢迎。在努力降低引进教材售价方面, 高等教育出版社做了大量和细致的工作。这套引进的教材体现了权威性、系统性、先进性和经

济性等特点。

教育部也希望国内和国外的出版商积极参与此项工作，共同促进中国信息技术教育和信息产业的发展。我们在与外商的谈判工作中，不仅要坚定不移地引进国外最优秀的教材，而且还要千方百计地将版权转让费降下来，要让引进教材的价格与国内自编教材相当，让广大教师和学生负担得起。中国的教育市场巨大，外国出版公司和国内出版社要通过扩大发行数量取得效益。

在引进教材的同时，我们还应做好消化吸收，注意学习国外先进的教学思想和教学方法，提高自编教材的水平，使我们的教学和教材在内容体系上，在理论与实践的结合上，在培养学生的动手能力上能有较大的突破和创新。

目前，教育部正在全国 35 所高校推动示范性软件学院的建设和实施，这也是加快培养信息科学技术人才的重要举措之一。示范性软件学院要立足于培养具有国际竞争力的实用性软件人才，与国外知名高校或著名企业合作办学，以国内外著名 IT 企业为实践教学基地，聘请国内外知名教授和软件专家授课，还要率先使用引进教材开展教学。

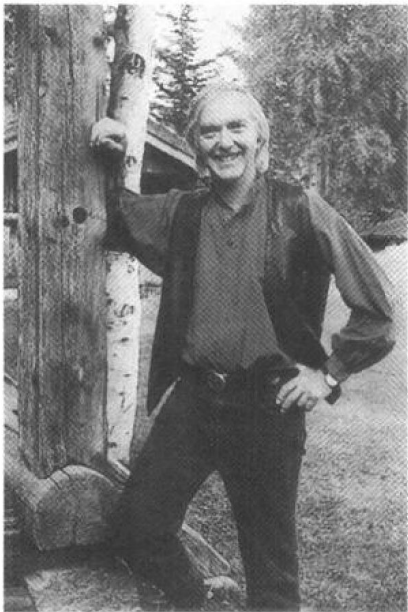
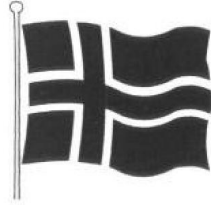
我们希望通过这些举措，能在较短的时间，为我国培养一大批高质量的信息技术人才，提高我国软件人才的国际竞争力，促进我国信息产业的快速发展，加快推动国家信息化进程，进而带动整个国民经济的跨越式发展。

教育部高等教育司

二〇〇二年三月

*To Else Marie
Alison, Mark, Kelcy, and Morgan
Eric and Rachel
Stacey and Britt*

About the Cover



**Cover Design: Painting by Sigmund Årseth, Artist and Teacher
Valdres, Norway**

Sigmund Årseth is recognized as a key figure in the development of *rosemaling* (a form of Norwegian folk art) in the United States. In 1967 he was funded by the American-Scandinavian Foundation to conduct classes in rosemaling at the Vesterheim Norwegian American Museum in Decorah, Iowa, and he judged the first National Nordic Fest Rosemaling Exhibition. In December of 1998 Sigmund demonstrated the art of rosemaling to large audiences at Union Station in Washington, DC, at an exhibit cosponsored by the Vesterheim Museum and the Norwegian Embassy in Washington.

Rosemaling, however, is only one facet of his skills as an accomplished artist. His landscapes and use of Norwegian folk art on the interior of homes is well-known throughout the United States and Europe. His unique ability to capture light in all its shades and intensities brings a special level of splendor and life to his work. Exhibits of his work have been held throughout the United States and in Sweden, Germany, Switzerland, Spain, and, of course, Norway.

Preface

In recent years the request for an increased number of practical examples in the text has reached a point where it had to be my first priority with this edition. I must admit that in the past I questioned this need because the student's electrical background is so limited at this point and most applications seem too complex to discuss in detail. However, after long deliberation, I believe I developed an approach that will satisfy this growing need, broaden the student's knowledge of electrical systems, develop additional interest in the field, and demonstrate how fundamental concepts are applied in some of the most complex systems. The new feature is entitled *Applications*. In total, the text now has some 50 different applications compared to fewer than 10 in previous editions. Some applications have operating systems clearly beyond the student's current level, but the descriptions are sensitive to this problem, and every effort has been made to be sure students are fully aware of what they should take away from the coverage. Their purpose is to stimulate, expose, educate, and answer some of the basic questions readers may have about electrical systems they use every day—to give them the knowledge about their field that would demonstrate to others that they have an awareness of how these systems work. As such, the Applications sections serve as a confidence builder.

There is no question that simply deciding what topics should be included was the most difficult part of adding the practical examples. In the past when users of the text and reviewers would request additional practical examples, I would turn to them and ask for specifics. The response I received clearly indicated that it was a difficult process for them also. I have never debated the need for the practical slant to the text—it was simply a matter of determining how it could be done to the student's advantage. Choosing the first few topics was the most difficult task, but I eventually discovered that if I simply took careful note of every electrical appliance or system I used during the day, I could identify applications that would be of interest to the student. I am naturally interested in the response to this new component of the text, whether it be positive or negative, and invite your comments to help define a direction for the future editions with regard to early exposure to practical examples.

The next most visible change is in the computer area, where the PSpice DOS coverage was dropped in favor of an increased level of coverage on PSpice Windows. I continue to believe that the coverage of PSpice

is sufficient to negate the need for a supplementary text on PSpice covering the analysis of dc and/or ac networks. With an hour or two in the computer lab at the beginning of the semester, most of the students are able to perform all of the tasks asked of them using the detail provided in this text. Of course, the instructor needs to be available to help when necessary, but most questions can usually be answered in quick order. This edition employs version 8 of PSpice because OrCAD's version 9 was still in the beta testing phase at the time of this revision. There are plans to prepare a supplement covering the changes in the front end of the software package.

The textbook coverage of BASIC and C++ remains unchanged because I felt they continue to serve an important function as an introduction to programming languages and how they differ from supplied software. It is certainly a luxury to have both in the text since the text is clearly at its maximum size. However, until I sense a negative reaction to the coverage, I would prefer to leave both as they now appear. In fact, size and coverage are important elements of the book for a number of reasons, and every attempt continues to be made to ensure that the majority of users are satisfied with both. I believe, however, that before the next edition is prepared, there will be a hard look at what might be deleted or reduced in scope. Here again, your comments are always welcome.

Less visible than the changes offered by the applications and computer coverage are those changes that are a result of a need to rephrase a paragraph, add a small section, or change an example. However, they are scattered throughout the book and appear in most chapters to respond to students' questions, reviewers' comments, letters from current users, and my own judgment. Over the years, every reading of the text points out areas that need to be reworked even if it is only a change in numbers or a word or two.

The laboratory manual accompanying *Introductory Circuit Analysis* has been revised in a number of important ways. One experiment was added at the beginning of both the dc and ac sections to ensure that the student has the mathematical and calculator skills required to get through the material typically covered in the syllabus. In addition, a number of resistor values and applied voltages were changed to ensure that 1/4-watt resistors could be used throughout. This was done to permit using the standard protoboard for setting up the circuits. Although we prefer to use separate sup-

porting blocks for each element to avoid the complexity introduced by the unique connecting pattern of the protoboard, replacement costs are expensive, and more and more institutions are now opting for this alternative approach. Another change is that a new experiment was written for the potentiometer that concentrates on the fundamental use of the device rather than producing a number of linear and nonlinear plots. Finally, each experiment has been carefully reviewed by both authors using the reaction of the student in the laboratory session and the resulting laboratory report to make changes.

Other ancillaries that complement this text include an Instructor's Solutions Manual, Homework Problem Supplement, Test Item File (printed test bank), Test Manager (electronic test bank), PowerPoint Transparencies, and Electronics Workbench circuit files on a CD-ROM packaged with this text.

The CD-ROM packaged with the text contains the following three items:

1. Approximately 100 EWB circuits from the textbook are rendered in Electronics Workbench.[®] EWB software version 5.X or higher is required to view these circuits.
2. Limited demonstration of EWB version 5.X software. This allows the reader access to 15 of the circuits on the CD-ROM.
3. A full student version of EWB version 5.X. This is available for purchase by contacting Interactive Image Technologies.

Users should direct all technical questions about the CD-ROM to Interactive Image Technologies at (800) 263-5552 or www.interactiv.com.

As with every edition, a number of people need to be recognized for their contributions. In particular, for his help with the applications, I extend my sincerest thanks to Jerry Sitbon for taking the time to respond to my many questions and patiently give me his viewpoint on a host of topics. His breadth of practical knowledge is extraordinary and is clearly evident in some of the applications in the text. Professor Leon Katz was very helpful with his suggestions and comments, as were a number of the faculty in the department. Professor James L. Antonakas of Broome Community College was very helpful with the C++ content, and Professor Boettcher of Albuquerque Technical Vocational Institute with the MathCAD coverage, both of which now play an important role in the text. Comments and suggestions from current users and reviewers of the text are always welcome and are taken seriously. I extend my deepest appreciation to the long list of contributors from both the educational and industrial communities. They all had a positive impact on the content of the 9th edition.

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As always, the production team at Prentice Hall in Columbus, Ohio, is superb in every sense of the word. Rex Davidson, the production editor and a good friend, somehow keeps the endless list of details in check, all the while bringing some enjoyment to the seemingly endless process. My editors, Scott Sambucci and Katie Bradford, were in clear control of the process from beginning to end, making sure I was continually aware of the progress of the text and how I should set my priorities. The copyeditors, Maggie Diehl (for the text) and Linda Thompson (for the laboratory manual), continue to amaze me with the questions they can ask, errors they can find, and suggestions they can make even though they may have a very limited engineering background. The marketing team of Debbie Yarnell and Ben Leonard was superb in getting the word out to the advertising staff and sales representatives.

Since the first edition of *Introductory Circuit Analysis* I have tried to choose a cover with an abstract

design that was pleasing to the eye rather than standard electrical hardware. For this edition, I am particularly thankful to Sigmund Årseth for creating the painting for the cover.

Finally, I must extend a very special tribute to Professor Joseph B. Aidala, who passed away recently. He was a close friend who took the time to help and guide me through my early years as an educator. A number of the methods and comments you see in the text are a direct result of his discussions with me about what to expect from a student and the best approach to complex material. He had a unique relationship with his students and was well respected by his peers and associates in the field. He had a special way about him that will be missed by us all.

My best wishes for a pleasant, productive, and healthy school year.

Robert Boylestad

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Contents in Brief

1 Introduction	1	15 Series and Parallel ac Circuits	611
2 Current and Voltage	31	16 Series-Parallel ac Networks	691
3 Resistance	59	17 Methods of Analysis and Selected Topics (ac)	721
4 Ohm's Law, Power, and Energy	95	18 Network Theorems (ac)	767
5 Series Circuits	125	19 Power (ac)	823
6 Parallel Circuits	167	20 Resonance	861
7 Series-Parallel Networks	207	21 Decibels, Filters, and Bode Plots	907
8 Methods of Analysis and Selected Topics (dc)	249	22 Pulse Waveforms and the <i>R-C</i> Response	985
9 Network Theorems	315	23 Polyphase Systems	1015
10 Capacitors	369	24 Nonsinusoidal Circuits	1055
11 Magnetic Circuits	427	25 Transformers	1081
12 Inductors	465	26 System Analysis: An Introduction	1121
13 Sinusoidal Alternating Waveforms	509	Appendixes	1163
14 The Basic Elements and Phasors	559	Index	1192

Contents

1

Introduction 1

- 1.1 The Electrical/Electronics Industry 1
- 1.2 A Brief History 2
- 1.3 Units of Measurement 7
- 1.4 Systems of Units 8
- 1.5 Significant Figures, Accuracy, and Rounding Off 11
- 1.6 Powers of Ten 12
- 1.7 Conversion between Levels of Powers of Ten 18
- 1.8 Conversion within and between Systems of Units 19
- 1.9 Symbols 21
- 1.10 Conversion Tables 22
- 1.11 Calculators 22
- 1.12 Computer Analysis 25

2

Current and Voltage 31

- 2.1 Atoms and Their Structure 31
- 2.2 Current 33
- 2.3 Voltage 36
- 2.4 Fixed (dc) Supplies 39
- 2.5 Conductors and Insulators 46
- 2.6 Semiconductors 48
- 2.7 Ammeters and Voltmeters 48
- 2.8 Applications 50
- 2.9 Computer Analysis 55

3

Resistance 59

- 3.1 Introduction 59
- 3.2 Resistance: Circular Wires 60

- 3.3 Wire Tables 63
- 3.4 Resistance: Metric Units 65
- 3.5 Temperature Effects 67
- 3.6 Superconductors 71
- 3.7 Types of Resistors 76
- 3.8 Color Coding and Standard Resistor Values 80
- 3.9 Conductance 82
- 3.10 Ohmmeters 83
- 3.11 Thermistors 84
- 3.12 Photoconductive Cell 85
- 3.13 Varistors 85
- 3.14 Applications 86

4

Ohm's Law, Power, and Energy 95

- 4.1 Ohm's Law 95
- 4.2 Plotting Ohm's Law 97
- 4.3 Power 100
- 4.4 Wattmeters 103
- 4.5 Efficiency 103
- 4.6 Energy 106
- 4.7 Circuit Breakers, GFCIs, and Fuses 110
- 4.8 Applications 111
- 4.9 Computer Analysis 116

5

Series Circuits 125

- 5.1 Introduction 125
- 5.2 Series Circuits 126
- 5.3 Voltage Sources in Series 129
- 5.4 Kirchhoff's Voltage Law 129
- 5.5 Interchanging Series Elements 133
- 5.6 Voltage Divider Rule 134
- 5.7 Notation 136
- 5.8 Internal Resistance of Voltage Sources 141

5.9	Voltage Regulation	144
5.10	Measurement Techniques	145
5.11	Applications	147
5.12	Computer Analysis	150

6

Parallel Circuits 167

6.1	Introduction	167
6.2	Parallel Elements	167
6.3	Total Conductance and Resistance	168
6.4	Parallel Networks	175
6.5	Kirchhoff's Current Law	177
6.6	Current Divider Rule	180
6.7	Voltage Sources in Parallel	184
6.8	Open and Short Circuits	185
6.9	Voltmeters: Loading Effect	188
6.10	Troubleshooting Techniques	189
6.11	Applications	190
6.12	Computer Analysis	195

7

Series-Parallel Networks 207

7.1	Series-Parallel Networks	207
7.2	Descriptive Examples	212
7.3	Ladder Networks	217
7.4	Voltage Divider Supply (Unloaded and Loaded)	219
7.5	Potentiometer Loading	222
7.6	Ammeter, Voltmeter, and Ohmmeter Design	223
7.7	Grounding	227
7.8	Applications	230
7.9	Computer Analysis	234

8

Methods of Analysis and Selected Topics (dc) 249

8.1	Introduction	249
8.2	Current Sources	249

8.3	Source Conversions	251
8.4	Current Sources in Parallel	254
8.5	Current Sources in Series	255
8.6	Branch-Current Analysis	255
8.7	Mesh Analysis (General Approach)	261
8.8	Mesh Analysis (Format Approach)	267
8.9	Nodal Analysis (General Approach)	271
8.10	Nodal Analysis (Format Approach)	278
8.11	Bridge Networks	283
8.12	Y- Δ (T- π) and Δ -Y (π -T) Conversions	287
8.13	Applications	292
8.14	Computer Analysis	299

9

Network Theorems 315

9.1	Introduction	315
9.2	Superposition Theorem	315
9.3	Thévenin's Theorem	322
9.4	Norton's Theorem	332
9.5	Maximum Power Transfer Theorem	336
9.6	Millman's Theorem	345
9.7	Substitution Theorem	348
9.8	Reciprocity Theorem	350
9.9	Applications	351
9.10	Computer Analysis	353

10

Capacitors 369

10.1	Introduction	369
10.2	The Electric Field	369
10.3	Capacitance	373
10.4	Dielectric Strength	376
10.5	Leakage Current	377
10.6	Types of Capacitors	377
10.7	Transients in Capacitive Networks: Charging Phase	382
10.8	Discharge Phase	388
10.9	Initial Values	393
10.10	Instantaneous Values	396
10.11	$\tau = R_{Th}C$	397

10.12	The Current i_c	400
10.13	Capacitors in Series and Parallel	402
10.14	Energy Stored by a Capacitor	406
10.15	Stray Capacitances	407
10.16	Applications	407
10.17	Computer Analysis	414

11

Magnetic Circuits 427

11.1	Introduction	427
11.2	Magnetic Fields	428
11.3	Flux Density	430
11.4	Permeability	431
11.5	Reluctance	432
11.6	Ohm's Law for Magnetic Circuits	432
11.7	Magnetizing Force	433
11.8	Hysteresis	434
11.9	Ampère's Circuital Law	439
11.10	The Flux Φ	440
11.11	Series Magnetic Circuits: Determining NI	440
11.12	Air Gaps	444
11.13	Series-Parallel Magnetic Circuits	446
11.14	Determining Φ	448
11.15	Applications	450

12

Inductors 465

12.1	Introduction	465
12.2	Faraday's Law of Electromagnetic Induction	465
12.3	Lenz's Law	466
12.4	Self-Inductance	466
12.5	Types of Inductors	467
12.6	Induced Voltage	470
12.7	R - L Transients: Storage Cycle	473
12.8	R - L Transients: Decay Phase	477
12.9	Initial Values	480
12.10	Instantaneous Values	483
12.11	$\tau = L/R_{Th}$	483

12.12	Inductors in Series and Parallel	486
12.13	R - L and R - L - C Circuits with dc Inputs	487
12.14	Energy Stored by an Inductor	490
12.15	Applications	491
12.16	Computer Analysis	498

13

Sinusoidal Alternating Waveforms 509

13.1	Introduction	509
13.2	Sinusoidal ac Voltage Characteristics and Definitions	510
13.3	The Sine Wave	516
13.4	General Format for the Sinusoidal Voltage or Current	520
13.5	Phase Relations	523
13.6	Average Value	527
13.7	Effective Values	534
13.8	ac Meters and Instruments	539
13.9	Applications	542
13.10	Computer Analysis	547

14

The Basic Elements and Phasors 559

14.1	Introduction	559
14.2	The Derivative	559
14.3	Response of Basic R , L , and C Elements to a Sinusoidal Voltage or Current	561
14.4	Frequency Response of the Basic Elements	572
14.5	Average Power and Power Factor	576
14.6	Complex Numbers	580
14.7	Rectangular Form	581
14.8	Polar Form	581
14.9	Conversion between Forms	582
14.10	Mathematical Operations with Complex Numbers	584
14.11	Calculator and Computer Methods with Complex Numbers	590
14.12	Phasors	592
14.13	Computer Analysis	598

15**Series and Parallel ac Circuits 611**

- 15.1 Introduction 611
- 15.2 Impedance and the Phasor Diagram 611
- 15.3 Series Configuration 618
- 15.4 Voltage Divider Rule 626
- 15.5 Frequency Response of the R - C Circuit 629
- 15.6 Summary: Series ac Circuits 636
- 15.7 Admittance and Susceptance 637
- 15.8 Parallel ac Networks 641
- 15.9 Current Divider Rule 649
- 15.10 Frequency Response of the Parallel R - L Network 650
- 15.11 Summary: Parallel ac Networks 655
- 15.12 Equivalent Circuits 656
- 15.13 Phase Measurements (Dual-Trace Oscilloscope) 661
- 15.14 Applications 664
- 15.15 Computer Analysis 671

16**Series-Parallel ac Networks 691**

- 16.1 Introduction 691
- 16.2 Illustrative Examples 692
- 16.3 Ladder Networks 701
- 16.4 Applications 702
- 16.5 Computer Analysis 710

17**Methods of Analysis and Selected Topics (ac) 721**

- 17.1 Introduction 721
- 17.2 Independent versus Dependent (Controlled) Sources 721
- 17.3 Source Conversions 723
- 17.4 Mesh Analysis 725
- 17.5 Nodal Analysis 732
- 17.6 Bridge Networks (ac) 743
- 17.7 Δ - Y , Y - Δ Conversions 748
- 17.8 Computer Analysis 753

18**Network Theorems (ac) 767**

- 18.1 Introduction 767
- 18.2 Superposition Theorem 767
- 18.3 Thévenin's Theorem 774
- 18.4 Norton's Theorem 786
- 18.5 Maximum Power Transfer Theorem 793
- 18.6 Substitution, Reciprocity, and Millman's Theorems 798
- 18.7 Applications 798
- 18.8 Computer Analysis 805

19**Power (ac) 823**

- 19.1 Introduction 823
- 19.2 Resistive Circuit 824
- 19.3 Apparent Power 825
- 19.4 Inductive Circuit and Reactive Power 827
- 19.5 Capacitive Circuit 830
- 19.6 The Power Triangle 831
- 19.7 The Total P , Q , and S 834
- 19.8 Power-Factor Correction 838
- 19.9 Wattmeters and Power-Factor Meters 842
- 19.10 Effective Resistance 843
- 19.11 Applications 846
- 19.12 Computer Analysis 849

20**Resonance 861**

- 20.1 Introduction 861
- 20.2 Series Resonant Circuit 862
- 20.3 The Quality Factor (Q) 864
- 20.4 Z_T versus Frequency 866
- 20.5 Selectivity 868
- 20.6 V_R , V_L , and V_C 871
- 20.7 Examples (Series Resonance) 872
- 20.8 Parallel Resonant Circuit 875
- 20.9 Selectivity Curve for Parallel Resonant Circuits 878
- 20.10 Effect of $Q_l \geq 10$ 881