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Electric Circuits

**Noel M. Morris
and
Frank W. Senior**

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Contents

Preface

1 Basic Concepts and D.C. Circuits	1
1.1 Fact Sheet	1
1.2 Worked Examples	13
1.3 Unworked Problems	22
2 Mesh Current and Node Voltage Analysis	30
2.1 Fact Sheet	30
2.2 Worked Examples	39
2.3 Unworked Problems	55
3 Waveforms and Fourier Analysis	60
3.1 Fact Sheet	60
3.2 Worked Examples	67
3.3 Unworked Problems	79
4 Reactance, Susceptance, Impedance and Admittance	85
4.1 Fact Sheet	85
4.2 Worked Examples	90
4.3 Unworked Problems	97
5 A.C. Series and Parallel Circuits	99
5.1 Fact Sheet	99
5.2 Worked Examples	103
5.3 Unworked Problems	114
6 Resonance	121
6.1 Fact Sheet	121
6.2 Worked Examples	128
6.3 Unworked Problems	138
7 Frequency Response	142
7.1 Fact Sheet	142
7.2 Worked Examples	151
7.3 Unworked Problems	162
8 Apparent Power, Power, Reactive VA and Power Factor Improvement	168
8.1 Fact Sheet	168
8.2 Worked Examples	172
8.3 Unworked Problems	186

9	Circuit Theorems I	189
9.1	Fact Sheet	189
9.2	Worked Examples	195
9.3	Unworked Problems	212
10	Circuit Theorems II	221
10.1	Fact Sheet	221
10.2	Worked Examples	224
10.3	Unworked Problems	236
11	Coupled Circuits and the Transformer	243
11.1	Fact Sheet	243
11.2	Worked Examples	249
11.3	Unworked Problems	260
12	Polyphase Systems	266
12.1	Fact Sheet	266
12.2	Worked Examples	276
12.3	Unworked Problems	288
13	Transients and the Laplace Transform	294
13.1	Fact Sheet	294
13.2	Worked Examples	311
13.3	Unworked Problems	329
Appendix 1	Complex Numbers	335
Appendix 2	Matrices and Determinants	340
Appendix 3	Computer Software for Circuit Analysis	347
Appendix 4	Partial Fractions	363
Bibliography		366
Index		367

Preface

This book is one of a series for use by students not only as a textbook but also as a guide to good practice in the solution of problems.

The topics in the book have been carefully selected to represent the most popular areas of study in a first year undergraduate, HND, and HNC course in Electrical and Electronic engineering. Each chapter opens with a Fact Sheet containing relevant definitions, principles, theorems and supporting information. This is followed by a set of worked examples illustrating the general area of study covered by the chapter. Each chapter concludes with a selection of unworked problems (with answers). The solutions in the book are the responsibility of the authors.

The topics covered include basic electrical and mechanical units, circuit theory including mesh current and node voltage analysis (incorporating both independent and dependent sources). Alternating waveforms are introduced in a chapter on waveforms and Fourier analysis and, following the treatment of reactance, susceptance and admittance, a.c. circuits are covered in some depth, including series and parallel circuits, resonance, and frequency response. The reader is also introduced to the concept of apparent power, power, reactive VA, and power factor improvement.

Two chapters are devoted to circuit theorems, including mesh current and node voltage analysis applied to a.c. circuits, Millman's theorem, Thévenin's theorem, Norton's theorem, duality, star-mesh and mesh-star transformations, superposition theorem, reciprocity theorem, compensation theorem, and the maximum power transfer theorem. Coupled circuits and the transformer are covered, as are polyphase systems, symmetrical components, and the measurement of power. Transients and the Laplace transform are dealt with in a comprehensive chapter.

Finally, the four appendixes cover complex numbers, matrices, determinants, the use of computer software appropriate to the solution of electric circuits, and partial fractions.

It is a simple matter to watch an expert building a structure; how different it becomes when you are faced with the same problem! So it is with Electric Circuit Analysis. It is easy to read how to solve problems, but solving a problem in practice calls for special abilities. The reader should develop his/her intellectual skills by attempting to solve the problems at the end of each chapter. Each question should be carefully studied, and possible techniques for its solution should be considered (there are often several ways of solving a given problem!); there are no shortcuts to mastering the technique of problem solving. Many of the solutions in this book have been checked using computer software, but not before they have been worked out the hard way using a pen and a calculator.

The authors and publisher wish to thank the Department of Electrical and Electronic Engineering of the Staffordshire Polytechnic and the School of Information Science and Technology of Liverpool Polytechnic for kind permission to publish extracts from examination papers. The questions selected are, in general, either part questions or short questions which ask for a particular type of solution.

Finally, each author would like to thank his wife, for whom the effort was happily made, for their support and forbearance during the writing of the book. The authors would also like to thank Mr W. Roberts for information on SPICE and Andrew Senior for his assistance in the preparation of the book.