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Electronic and Electrical Calculations

Noel M. Morris

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This book is dedicated to Barbara, Helen, Ian, Kathy and Anthony

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Preface

This book deals with the methods and techniques used in problem solving in Electronic and Electrical circuits, ranging from manipulating equations to op-amp circuits, logic circuits and power engineering

The material is presented in the form of 'what you need to know first, is dealt with first'. The author has made every effort to cover all the topic area in a large subject matter, and the text is supported by many worked examples and informative diagrams.

Since each section is self-contained, the more experienced reader can turn to the section they are interested in and deal with that topic.

The book covers all the Principles for BTEC National Certificate in Electronic and Electrical Engineering courses, and a very considerable part of the Principles for Higher National Certificates. It will be invaluable for students requiring further explanation of the solution of problems in electronic and electrical engineering, since methods of carrying out computations are both fully and clearly explained.

As colleges move into the GNVQ philosophy, more emphasis is placed on students researching and learning for themselves, and this book will be an invaluable resource.

Each chapter commences with an introduction which describes the basic theory involved, followed by a range of worked examples. The concluding section of each chapter describes computer listings in the BASIC language, which are particularly suitable for the type of problems in that chapter.

This book will provide invaluable support for the following:

- NVQ and GNVQ Levels II and III
- BTEC National and Higher National Electronics/Electrical courses
- C & G LI Parts II and III
- 'A' level Electronics courses
- 1st Year Electronics/Electrical/Physics degrees
- Home constructors who need to understand the 'why' as well as 'how'.

Further information about the software is contained in 'A note about the computer programs' on p. xxii.

Chapter 20 describes the use of SPICE software, which is widely available, and can be used to solve almost any type of electronic or electrical problem, details of which are given on pp. xxii and xxiii.

Each chapter also contains a large number of exercises on which the reader can test their skill; the solution to the exercises is provided at the end of the book (p. 437). The exercises have been presented in the order in which they appear within the chapter and, within this grouping, they have been graded in order of difficulty. Finally, each chapter is concluded by a summary of important facts, which provides an easy to read summary of the vital data in the chapter.

A bibliography of other related titles in the Masters series is given at the end of the book.

The book is designed to suit the busy reader, so that you can quickly obtain the information you need about solving a particular type of problem.

The reviewers of the book deserve many thanks for their very helpful and constructive comments.

I would like to thank Mr P. Goss, Technical Manager of ARS Microsystems, for his advice and assistance in connection with Chapter 20, where the use of PSpice software is described. I am indebted to Mr A. Lewis, Head of Management Services, Longdean, Hemel Hempstead, for advice received. Finally, I would like to thank my wife for her support, without which the writing of this book would not have been possible.

NOEL M. MORRIS

A note about the computer programs

The computer programs in this book are written in QUICK BASIC, and some minor amendments may be required to the programs for use in other BASIC dialects. The programs have been written using line numbers (which, strictly speaking, is not necessary for QUICK BASIC) so that simple instructions such as GOTO can be used. On the whole, simple programming techniques have been adopted so that the programs are easy to understand.

Many of the programs introduce the reader to the use of menus and other topics. The programs enable the reader to gain expertise in program writing, and they may easily be modified by adding extra lines to them. If syntax errors occur during the loading of the programs, it may mean that some characters such as parenthesis, commas or semicolons have either been overlooked or changed by the reader. Any errors can be corrected by studying the manual for your computer.

To save the reader the effort of entering the programs into their computer, all of the programs in the book are available from:

AVP Educational Software
School Hill Centre
Chepstow
Gwent NP6 5PH
Tel: 01291 625439
Fax 01291 629671

The AVP catalogue number is COM 476. All the BASIC files on the disc have the extension '.BAS', and are stored in a text format so that they may be transferred to any word processor. The manual for the disc is also available on the disc in the file MANUAL.TXT, which is in a text format which may be read by any word processor.

Also included on the disc are a number of PSpice files associated with Chapter 20, including 17 '.OUT' files, together with other files relating to PSpice (a total of 74 files in all on the disc). The files which describe the circuits have the extension '.CIR', and other files have the extension '.CFG' or '.DAT'. Files which contain the results have the extension '.OUT'; these files also contain the PSpice circuit description which is identical to that in the corresponding '.CIR' file. An

advantage of having the '.OUT' files is that they may be read by a word processor, and it is not necessary to have PSpice software installed in your own computer in order to study them. Readers need PSpice installed in their computer in order to run '.CIR' files.

All the programs in Chapter 20 (and for many problems in other chapters) were developed using PSpice software. Versions of this software for PCs usually have on-disc documentation, and is available from the address below. The software is also available through the pages of magazines dealing with computer shareware.

ARS Microsystems
Herriard Business Centre
Alton Road
Basingstoke RG25 2PN

The majority of the Worked Examples and Exercises in this book have been checked by the use of either the BASIC language programs or by PSpice.