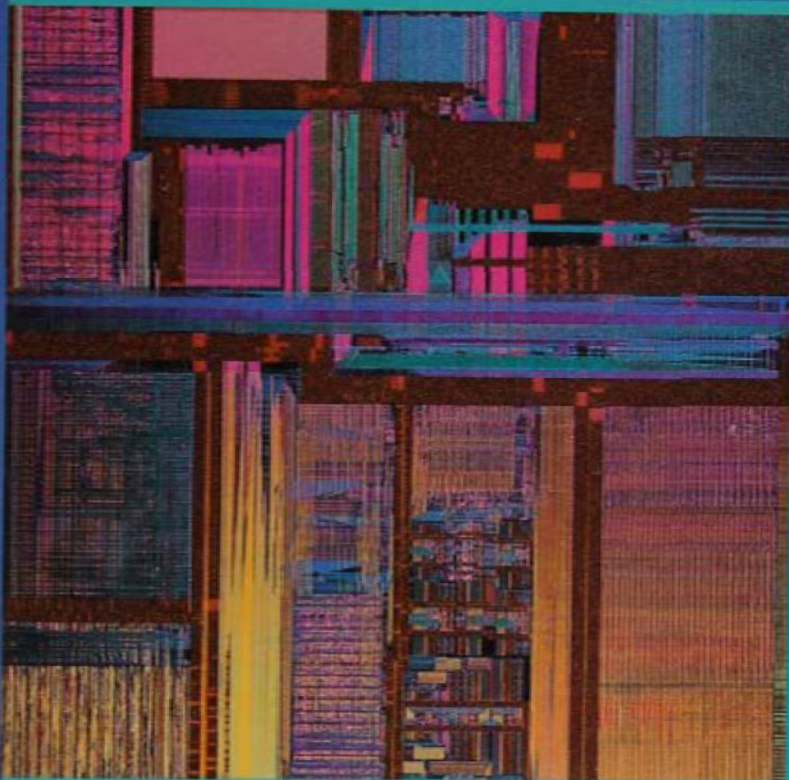


Introduction to

ELECTRICAL ENGINEERING



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Introduction to Electrical Engineering

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Preface

P.1

Purpose

This book is intended to serve as a text for an introductory course or course sequence in electrical engineering. It is a broad and comprehensive introduction to the field designed to provide the student with an understanding of the fundamental concepts and a practical working knowledge of the application of these basic principles to real-world, up-to-date problems.

The fundamental strength of the text is the clear, solid and concise presentation of the essential components of the analysis of electric circuits, electronic circuits and systems, and electromechanical systems and safety. Furthermore, the book contains a number of other related topics outlined below, that greatly enhance the flexibility of presentation. The material is organized and presented in a manner that permits the instructor great latitude in the selection of topics and their order of presentation.

When used with a survey course comprising one or two semesters, typically only selected chapters or portions of chapters can be covered. In general, because of the breadth of the electrical engineering field, there simply is insufficient time to cover all the important elements of the discipline. However, this text is designed to assist the skillful instructor to empower students with the confidence and understanding that they are capable of solving electrical engineering problems outside of those specifically addressed in class. By becoming familiar with the entire organization of this book and treating it not only as a text, but as a reference as well, the student can learn one of the most crucial points about any survey course—how to access the information they need when they need it in the future. In this way the experience of a survey course provides a life-long benefit.

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All the major disciplines within electrical engineering are represented in this text. Therefore, if students retain this book as part of their permanent library, they will be able to address throughout their careers the many electrical and electronic issues that literally permeate the engineering problems that are encountered in our modern technological world. In addition, the book is designed to be a very useful reference for students who wish to take the Fundamentals of Engineering exam (see Appendix C) that is a prerequisite for becoming licensed as a Professional Engineer.

This text is also suitable for the reader who wishes to use a self-study approach to learn the fundamentals of electrical engineering. The many worked examples, drill problems, and careful explanations within each chapter test the student's understanding, clarify key points, and provide necessary feedback.

For students who may later study many of these subjects in more detail, this text provides a clear presentation of fundamentals including the relationships among the various disciplines within electrical engineering and a comprehensive foundation for further advanced study in any selected area.

P.2

Features

This book contains a number of unique features that enhance its use as a survey text and valuable reference.

- The first chapter sets the stage for the study of electrical engineering topics by outlining the many disciplines within the field, their interrelationships, and the work of an electrical engineer including the value of operating as a member of a team consisting of many professionals with diverse backgrounds.
- The book is organized around six major parts, each of which represents a principle area of study within the field. The outline of topics within each part provides a logical grouping of the subject material as well as the relationship of these subjects to the field as a whole.
- After a brief study of the first few chapters, the book is organized in such a way that the topics may be selected for presentation in almost any order. Chapters are designed, to the extent possible, to be independent; therefore, the instructor has great flexibility in the selection of chapters, or sections within a chapter, to meet the special objectives of any particular course.
- A large number of examples, strategically placed, reinforce learning. In addition to these examples, which follow essentially every topic after it's introduced, there are a number of drill problems designed to quickly test the readers' understanding of the material. The combination of these features enhances both learning and retention by providing immediate demonstrations of the concept under discussion.
- The frequent use of analogies is a valuable aid to the newcomer in developing intuition for the fundamental principles. The use of fluid flow and mechanical analogies have been shown to be particularly helpful in quickly providing new students or those from other engineering disciplines an intuitive grasp of the principles that govern electrical engineering subjects.

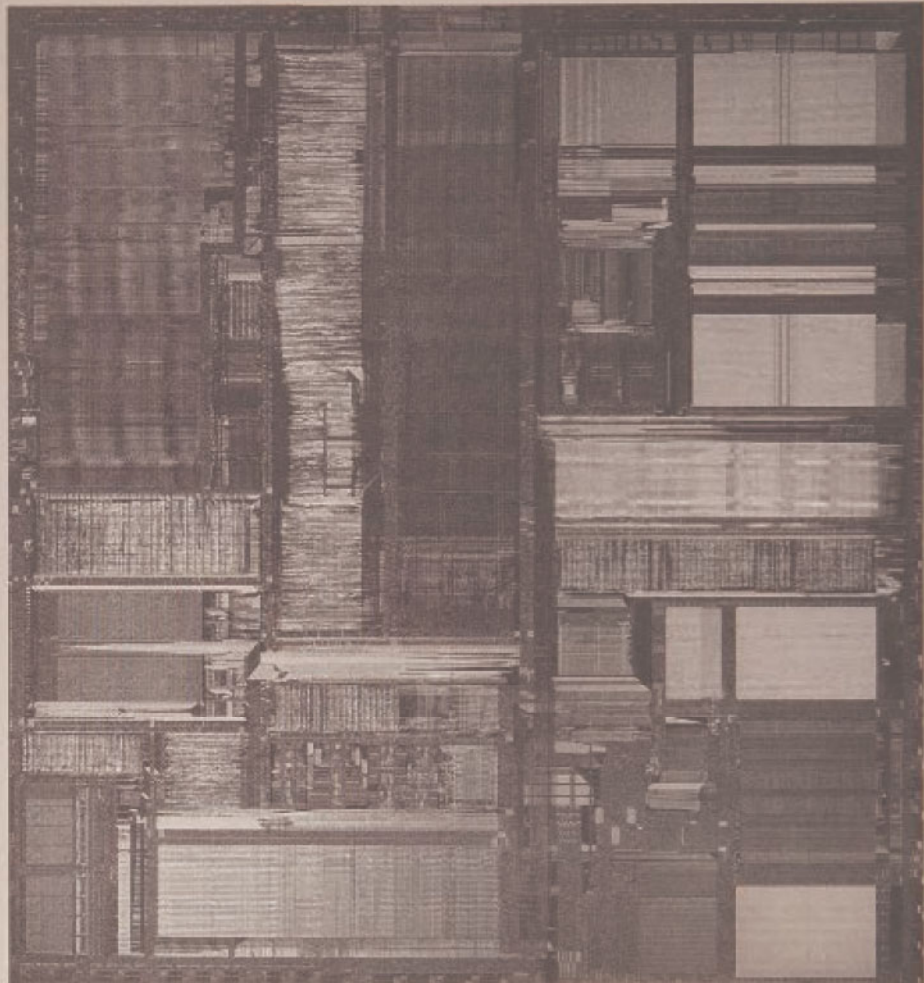


Figure P.2 An example of an advanced integrated circuit, the Intel Pentium™ Processor, contains 3.1 million transistors. (Courtesy of Intel; Pentium is a trademark of Intel Corporation)

P.5 Notation

Two of the most commonly used symbols in the study of electrical engineering are those for voltage (V) and current (I). The use of lowercase or uppercase letters and the particular subscript used with the letter provide information about the voltage or current as illustrated in the following example:

V , V_1 , or V_A = a dc (direct current) value. The use of a capital V or I with number or capital subscript following indicates a constant, dc value.

$v(t)$, $v_1(t)$, $v_a(t)$, or v_A = the instantaneous value. The use of lowercase v or i with “(t),” or with a capital subscript, indicates the total instantaneous value “as a function of time.”

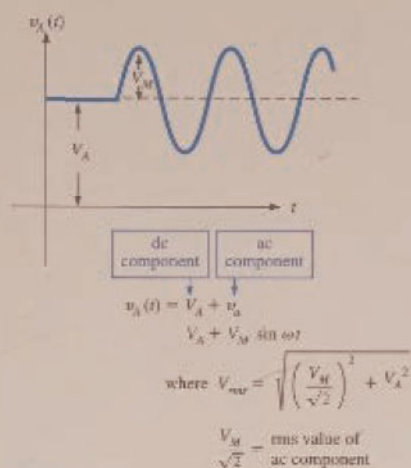


Figure P.3 Notation for Voltage and Current

V_M , V_m , I_M , or I_m = the amplitude or maximum value of a sinusoidally varying voltage or current.

V_{rms} or I_{rms} = the RMS or root-mean-square value of a sinusoidally varying voltage or current.

v_a or v_1 = the instantaneous value of the time-varying component (zero average).

The use of these quantities is illustrated graphically in Fig. P.3.

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