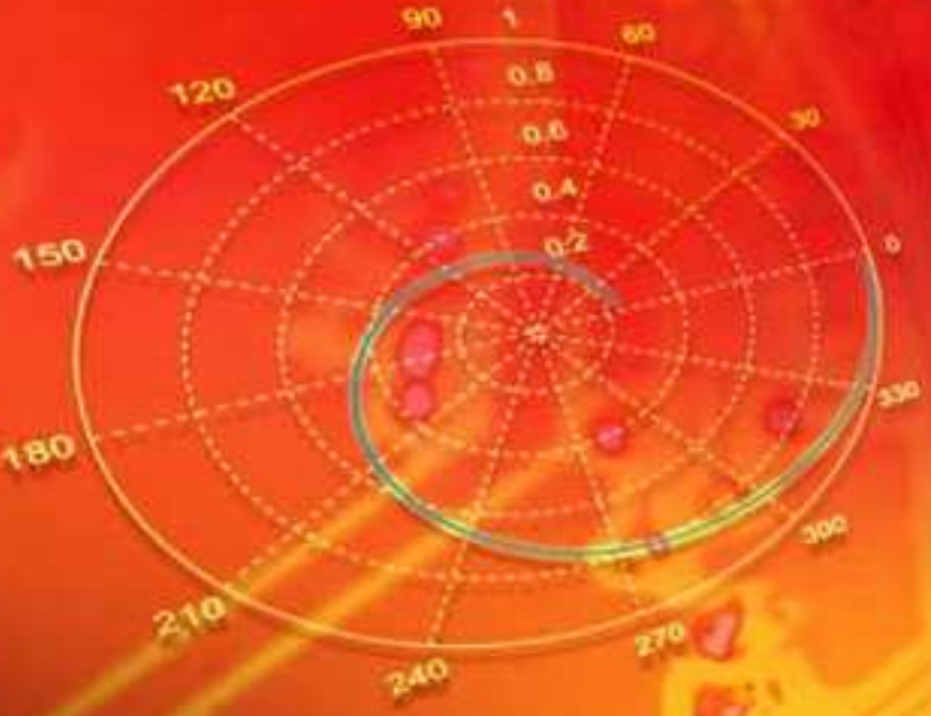
Microcontroller Based Applied Digital Control

Dogan Ibrahim



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Contents

Preface

Computers now form an integral part of most real-time control systems. With the advent of the microprocessors and microcontrollers in the last few decades the use of computers in control applications has been ever growing. Microcontrollers are single-chip computers which can be used to control real-time systems. Such controllers are also referred to as embedded real-time computers. These devices are low-cost, single-chip and easy to program. Microcontrollers have traditionally been programmed using the assembly language of the target processor. It is now possible to program these devices using high-level languages such as BASIC, PASCAL, or C. As a result of this, very complex control algorithms can be developed and implemented on the microcontrollers.

This book is about the theory and practice of microcontroller based automatic control systems engineering. A previous knowledge of microcontroller hardware or software is not required, but the reader will find it useful to have some knowledge of a computer programming language.

Chapter 1 of the book presents a brief introduction to the control systems and the elements of computer based control systems. Some previous knowledge of the theory of continuous-time control systems is helpful in understanding this material.

Chapter 2 is about system modelling. Modelling a dynamic system is the starting point in control engineering. Models of various mechanical, electrical, and fluid systems are introduced in this chapter.

Chapter 3 is devoted to the popular PIC microcontroller family which is described and used in this book. The PIC family is one of the most widely used microcontrollers in commercial and industrial applications. The chapter describes the features of this family, and basic application notes are also given.

The book is based on the C programming language known as *PICC Lite*. This is distributed free by Hi-Tech Software and is used to program the PIC family of microcontrollers. Chapter 4 gives a brief introduction to the features of this language.

The microcontroller project development cycle is described in some detail in Chapter 5. The knowledge of the microcontroller development cycle is important as the developed controller algorithm has to be implemented on the target microcontroller.

Chapters 6 and 7 are devoted to the analysis of discrete-time systems. The terms *discrete-time system, sampled-data system* and *digital control system* are all used interchangeably in the book and refer to the same topic. The sampling process, z-transforms, and the time response of discrete-time systems are explained in detail in these two chapters.