MICHAEL LANDON McKISSICK

COMPUTER-AIDED DRAFTING AND DESIGN

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For Kimber Lee Bell

PREFACE

As has happened in data processing and word processing, computer-aided drafting and design has moved from a trendy new approach to a requirement for maintaining the competitive edge. Few engineering firms find themselves doubting the need for CADD in their work, but finding the resources to obtain the systems remains a problem. As the industry finds more and better ways to meet the needs of the market, more and better CADD systems will be in use by a more diverse group of users.

The dream of a CADD workstation in every office is not that far off. The need for trained CADD operators to make use of all this computing power will be great. For someone considering the drafting and design field, the study of CADD has become a necessity. For someone already in the field, CADD training may be the only path to long-term job security.

This book is aimed at the drafter-in-training or experienced drafter enrolled in a postsecondary CADD program. The concepts and information are not meant as an introduction to or overview of computer-aided drafting and design. The text is intended to dovetail the student's knowledge of drafting with the way in which CADD systems accomplish drafting tasks. In addition, those people whose job it is to purchase or specify CADD equipment will find the information they need to ask intelligent questions during the system specification phase. In any case, a knowledge of computers is not required.

In Chapter 1 computers are explained in sufficient depth to demystify their ability and present their strengths and weaknesses. Chapter 2 will explain how a number machine can be made to draw. Chapters 3 and 4 present some of the computer hardware needed for CADD, and Chapter 5 gives the student what is needed to prepare a CADD drawing file for drafting work.

Chapters 6 through 14 detail the methods used to draw ordinary drafting elements on the computer and show how CADD systems go beyond standard drafting techniques, giving the CADD drafter much more flexibility in his or her work. Although CADD systems vary in the specifics of their commands, the concepts are universal and essential to successful CADD training. This section of the text will work well with the operating manual of the system used for training as a supplement. If no CADD system is available, students will find that once the concepts have been mastered, they are easily translated into the specifics of the CADD system which they are employed to operate. In addition, transfer of skills from one system to another is greatly enhanced if the student is well grounded in CADD fundamentals.

The remaining chapters relate to the use of CADD systems for functions beyond the scope of manual drafting. Here the student will examine three-dimensional modeling, the use of analytical programs that employ CADD models to perform engineering calculations, and the use of conventional data in conjunction with CADD drawings.

This book grew out of a need for a text that bridges the gap between books that *sell* CADD to students and system manuals provided by manufacturers, which consist of a list of commands. Students of CADD need to know not just the how-to but the why, and this book adheres to the essential basics of the subject while giving the student a feeling for the *craft* of CADD drafting.

Throughout the text, students will see that the computer, although very powerful, is just a tool for their trained minds to manipulate, and that the future of drafting is still in their hands.

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MICHAEL L. MCKISSICK

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CONTENTS

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HOW COMPUTERS WORK

PREVIEW

To use computers, it is important to understand their basic functions. In this chapter we take a brief look at the history of computers, then look inside to see where their power lies. How digital computers work with data is illustrated, and we get into just enough about bits and bytes to clear up their mystery. We examine analog and digital information and see how binary numbers are used. Finally, a brief look at the hardware used by CADD systems is provided as a background for more thorough coverage in Chapters 3 and 4.

Modern computers have found their way into nearly every aspect of our daily lives. More and more we see the computer being used to simplify or speed up some function or provide more accurate results than are possible manually. This rise in popularity has not happened overnight. The potential power of the computer has been envisioned for some time. Making that potential a reality has taken many years.

1.1 ANALOG DEVICES

The first "computers" were in fact more like mechanical counters which use the position of beads as an indication of the numbers being added. Such devices are said to be *analog* devices. Analog devices use position or quantity to form an *analogy* with the desired numerical output.

A good example of such a device is a clock. Even without the numbers, we

Figure 1.1 Computer in use. (Courtesy of AT&T.)

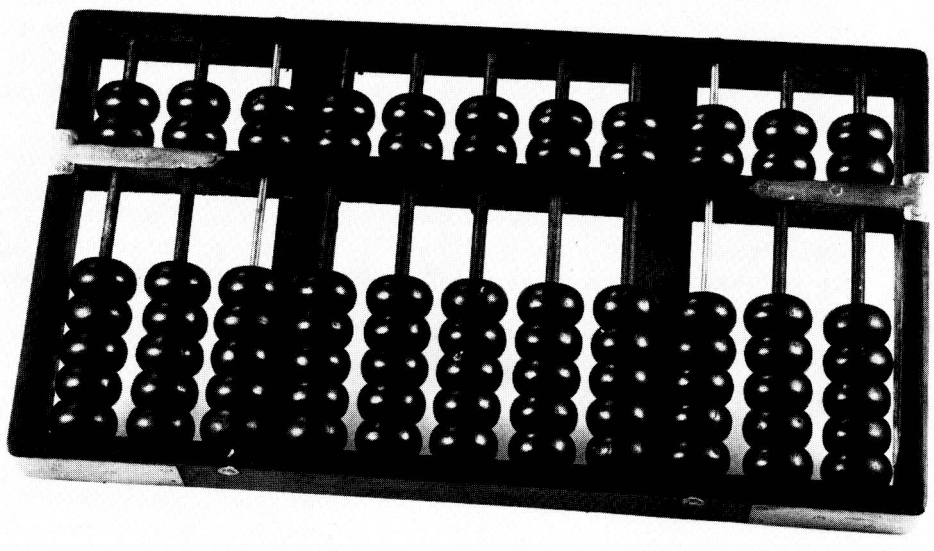

Figure 1.2 Abacus. (Courtesy of IBM Corporation.)

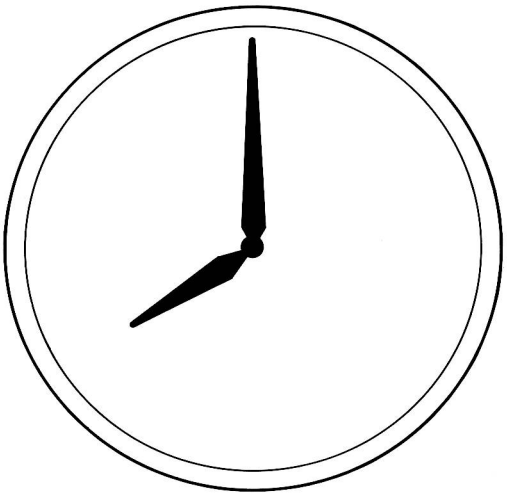

Figure 1.3 Numberless clock.

can determine the time of day by the *position* of the hands. The hands, which are moved by an electric motor or mechanical escapement, move in coordination with the earth's rotation. Thus two full revolutions of the hour hand signal the completion of one full revolution of the earth—one day. The analog clock has some advantages. By merely glancing at such a clock, we can determine the time of day *and* get a graphic indication of what percentage of the day has gone by.

Other common analog devices with such features are the speedometer and gas gage in your car. There are disadvantages to analog devices, however. For one, an extremely accurate reading may not be easy or possible to obtain. Also, some amount of interpretation is necessary. A child who knows that 8 o'clock is bedtime may not be able to grasp how that information can be deduced from the moving hands on a dial.

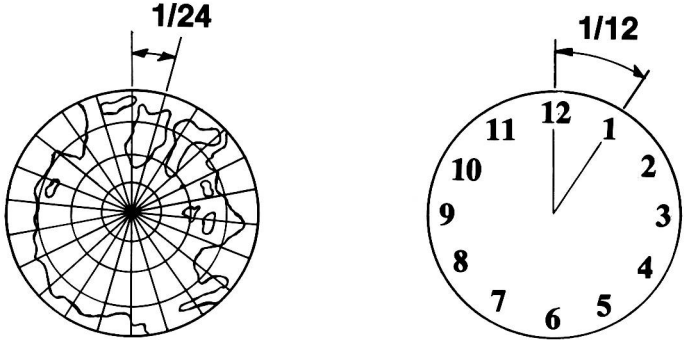

Figure 1.4 Clock and earth, showing relationship.