STEP-BY-STEP DESIGN

OF

MOTION CONTROL SYSTEMS

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accuracy.

The second part of the book focuses on programming the motion. Here we assume that the control system is indeed stable and that the motor position follows the commanded trajectory. The emphasis now is on commanding the appropriate trajectory that results in the required motion.

It was indicated previously that the generation of motion consists of two major parts: generating the required profile and following it. The first part of the book deals with forcing the motor to follow the required trajectory. The second part deals with generating the profile.

Chapter 10 starts with a description of general programming tools. Chapters 11 and 12 discuss two special modes of motion: coordinated motion and contouring. Chapters 13, 14, and 15 deal with special motion types known as electronic gearing, tension control, and dual-loop control.

The discussion presented here is general in nature and the design methods apply to most motion controllers. However, in order to provide specific illustrations and examples, we describe the implementation of the motion programming with the language used by Galil controllers.

A motion controller can be "told" by a host computer to perform a move by any of the controlled motors. The most simple move is one with a trapezoidal velocity profile as illustrated in Figure 10.1. This move is completely characterized by the distance, slew velocity, and acceleration and deceleration rates.

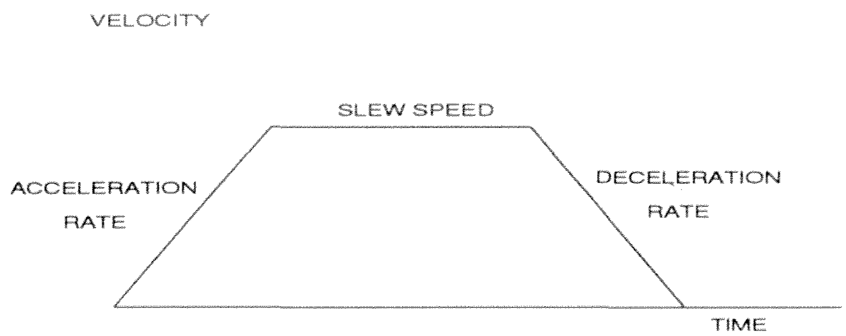

Figure 10.1: Trapezoidal Velocity Profile

The most basic form of specifying these motion parameters is in units of resolution. The process is illustrated by an example.

Example 10.1

Consider a system where the encoder resolution is 4000 counts/rev and the objective is to rotate the motor 1 rev in 0.3 s. Furthermore, both the acceleration and the deceleration times are 0.1 second each.

DC 200000 Deceleration rate
BGX Start motion of X motor

The host computer sends the characters indicated by the program shown above and the motion starts immediately.

Another type of simple motion is the jog move. Here the motor is commanded to run indefinitely at a specified speed. The motion parameters in this case are limited to the speed, acceleration, and deceleration. These parameters can be expressed in units of resolution as illustrated below.

Example 10.2

Instruction	Interpretation
JG 40000	Jog speed
AC 400000	Acceleration rate
BGX	Start X motion

The generation of more complex moves is described in the following chapters.

Stored Programs

The instructions for performing the motion can be issued directly from the host computer, resulting in an immediate move. This mode, the immediate mode, requires the continuous involvement of the host computer. An such as "Execute Program A." The controller will then receive the instructions from its memory without the intervention of the host computer.

To illustrate the concept, consider the move described in Example 10.1. Tc perform the same move from a stored program, the host modifies the progra by adding a label, #A, for example, and an end statement, EN. The resultin program is as follows:

Example 10.3

Instruction	Interpretation
#A	Program label
PR 4000	Distance
SP 20000	Speed
AC 200000	Acceleration
DC 200000	Deceleration
BGX	Start X motion
EN	End of program

The host downloads this program to the controller memory, where th program remains inactive. To execute the program, the host sends th command

XQ#A

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