System Block Diagram

Title of Project: PC–based Control Workstation for Controller Algorithm Evaluation

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Introduction

The objective of the project is to create a PC-based control workstation to control a plant consisting of a Pittman DC motor/rotary encoder. The load for the motor is a DC generator with a power dissipation resistance. A data acquisition board has been purchased from Quanser Consulting to interface the plant to the PC work station. The acquisition board contains I/O ports, D/A, and A/D converters.

Figure 1 provides a general block diagram containing inputs and outputs for the system. Inputs consist of user commands for velocity and acceleration through a C code program. The only system output is motor shaft velocity; acceleration is obtained through a differentiation of velocity.

Objectives

Objectives for the project consist of:

- Motor drive control from a D/A converter and a linear power amplifier.
- Evaluation and purchase of PWM board.
- Motor bidirectional drive control via PWM board.
- Development of software user-friendly interface.
- Obtain a mathematical model for the system.
- Design of closed loop controllers in C code for velocity control on a 200 MHz Pentium computer.
Hardware

Hardware consists of a 200MHz Pentium-based PC, a data acquisition board including D/A and A/D converters, a pulse width modulation board used for motor velocity control, and the system plant shown in figure 2. Initially the D/A converter will be implemented for motor velocity control, however, to reduce system cost, a PWM board will be purchased to replace the D/A. The system plant consists of a power amplifier, Pittman DC motor, an external DC motor functioning as a generator, and a potentiometer to control the motor load. The Pittman motors include an internal encoder for determining motor shaft velocity.

![Figure 2. Low Level System Block Diagram](image)

Software

A C code program will be used to provide a user friendly interface for the workstation. Through this interface, the user will be able to select the desired motor velocity, motor acceleration, input type (step, ramp, or parabolic). Furthermore, the program will be used to display various internal system signals such as motor shaft velocity, acceleration, and armature current. A high level software flow chart is provided in figure 3.

Software will also be used to implement the following system controllers:
- Proportional Gain
- Proportional Derivative
- Proportional Integral
- Proportional Integral Derivative
- Feed-Forward
Figure 3. High Level Software Flowchart