

Real Time Cascade PI Control for Position Monitoring of DC Brushed Motor

Muzsee Ibrahim, Sy. Najib Sy. Salim, M. Nizam Kamarudin, Ammarashid Noordin

Abstract— This paper depicts the development of real time motor drive system. The modelling of Direct Current (DC) motor is vital in this work and hence is discussed in brief. Experimental setup consists of DC motor, rotary encoder, interface card and personal computer is thoroughly configured to obtain useful data such as control signal, speed and position of the motor. User interface and control algorithm is developed using Microsoft Visual C#. Proportional-Integral (PI) algorithm is developed to perform cascaded control of the DC motor. The system equipped with fixed inner current loop control parameters while the outer speed and position loop is varied to obtain the most satisfied position and speed of each motor. Through comparison of demanded speed and position, literal analysis of real time speed and position is thoroughly discussed.

Keywords— Proportional-Integral (PI) Control, DC brushed motor, position control, Cascade control.

I. INTRODUCTION

Since data collection and systems monitoring are vital in industrial environment, development of real time facilities for control systems has become needy for engineers and technologists. As such, this paper focuses on the real time development of DC motor drive systems. According to [1], a cascade control of DC motor is the most effective for DC drives as it uses first inner current loop and enclosed by outer speed loop. However, for industrial needy such as robotics arm or pick and place systems, it is desired to attach position loop to the system. Therefore, this paper proposed a newly implemented real time cascade control system without inner current loops as shown in Fig. 1.

The system consists of primary and secondary loop so-called speed and position loop respectively. All variables abbreviated as CO2, PV2, PV1 and SP1 represent secondary control output, secondary process variable, primary process variable and primary set point respectively. Note that D2 represents a disturbance that impacts the PV2 before they impact PV1. Fig.2 shows the system configuration where PIC micro-controller from Microchip is used to build the decoder.

Muzsee Ibrahim and Sy. Najib Sy. Salim are with department of Control, Instrumentation and Automation, Universiti Teknikal Malaysia Melaka, Malaysia. (email: muzsee@utem.edu.my and sy.najib@utem.edu.my)

M. Nizam Kamarudin is with department of Power Electronics and Drive, Universiti Teknikal Malaysia Melaka, Malaysia. (email: nizamkamarudin@utem.edu.my)

Ammarashid Noordin is with department of Mechanicals, Universiti Teknikal Malaysia Melaka, Malaysia. (email: ammashid@utem.edu.my)

The purpose of decoder is to decode signal from rotary encoder. The outputs of the rotary encoder are sets of pulses train. Specifically, the decoder is mixed quadrature decoder [2].



Fig. 1. Cascade control of DC motor with inner speed and outer position loop

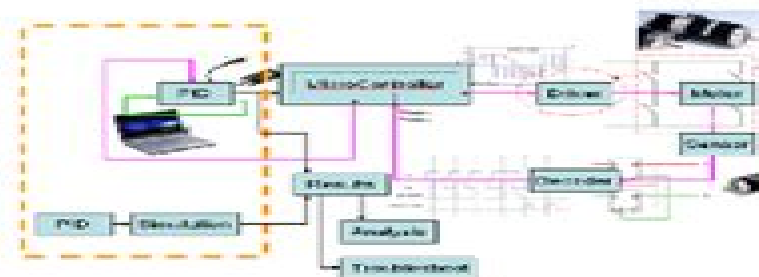


Fig. 2. System configuration

II. DC MOTOR MODEL

A separately excited DC motor is used because it has an independent voltage supplies to the field and armature windings. This type of structure gives advantage of more control over the motor performance [1]. A brushed M586TE motor manufactured by McLennan is used in this project. The parameters are listed in Table 1. Motor back emf and load torque makes the motor equation non-linear. As such, the state space equations (1), (2) and (3) is derived to provide the simplicity of modeling task. The model is depicted in fig. 3.

Cascade Control Of Dc Brushed Motor

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Cascade control of DC brushed motor Ninad Gondhalekar, 2014-11-10 Master's Thesis from the year 2014 in the subject Electrotechnology grade Distinction University of Newcastle upon Tyne language English abstract The aim of this project is to control speed of permanent magnet DC motor by using technique called cascade control In this project the working of PMDC motor H bridge using unipolar switching scheme PI controller in current loop and speed loop of cascade control is first studied by simulating in MATLAB software and after that practically applied cascade control on PMDC motor using flexible inverter board In this project dsPIC30F3010 is programmed and armature current and armature voltage is controlled by inner current loop and outer speed loop of cascade control In this project investigation of effect of anti windup C code on drive performance is done The flexible board has microcontroller current sensor and H bridge circuit on it which will be used to supply voltage to PMDC motor As a PMDC motor DC motor rig is used which has two identical DC motor coupled together and one motor have encoder fitted on it and other motor have tachogenerator fitted on it

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