

PLC BASED SPEED CONTROL OF DC BELT CONVEYOR SYSTEM

MOHD HEIDIR MOHD SHAH

A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Masters of Engineering (Electrical-Mechatronics & Automatic Control)

Faculty of Electrical Engineering
Universiti Teknologi Malaysia

JANUARY 2013

*To my mother, father, wife and son, Ainon, Mohd Shah , Siti Arfah and Aqeel
Khusaini for their encouragement and blessing, support and caring...*

ACKNOWLEDGEMENT

In The Name of God.

I am grateful to God on His blessing in completing this project.

I would like to express my gratitude to my project supervisor, Professor Dr. Mohd. Fua'ad bin Hj. Rahmat for his encouragement, critics, and guidance. Under his supervision, many aspects regarding of this project has been explored, and with the knowledge, idea and support, this project can be completed.

Highest appreciation to my lecturers who had helped me in completing my studies. Without their continued passion in sharing knowledge, I would not be able to gain any understanding during study.

I also would like to express my gratefulness to my close friends Khairul Anuar, Muhairi, Easwandy, Hafidzah, Adli, Asral, Rohaya and Zamani for their caring and supports.

Finally I would like to dedicate this achievement to my parents, family and friends who have helped me directly or indirectly and sacrificed a lot in the completion of this study.

ABSTRACT

Conveyor belt system is one of the most common transfer system used in industry to transfer goods from one point to another in a limited distance. It is used in industries like the electro-mechanical/mechanical assembly manufacturing to transfer work piece from one station to another or one process to another in food industries. Belt conveyor system is also used in coal mining industries but a number of conveyor modules needs to be attached together to achieve long distance transfer. The belt conveyor system used in this project is driven by a DC motor and the model of the system will be determined using fundamental laws. The parameter of the model will then be estimated offline using System Identification toolbox in Matlab. For this reason, an open loop experiment will be done by injecting Sine Wave signal to the DC motor driver to obtain the experimental data for estimation process. This model is then used in Matlab for simulation purpose. In this project, two controllers will be designed. The PID controllers will be designed to provide comparison to the main controller which is the Adaptive Fuzzy PID controller. Both controllers will be simulated in Matlab's environment and will also be implemented on real hardware where the algorithm will be written in PLC using SCL language. Both simulation and experimental results shows that Adaptive Fuzzy PID controller performs better and adapted to the changes in load much faster than the PID controller. This project has also proved that PLC is capable of performing high level control system tasks.

ABSTRAK

Sistem penghantar tali sawat merupakan salah satu sistem pemindahan yang paling biasa digunakan dalam industri untuk memindahkan barangan dari satu tempat ke satu tempat yang lain dalam jarak yang terhad. Sistem penghantar tersebut juga boleh diguna pakai untuk jarak yang jauh tetapi beberapa modul penghantar perlu disambung untuk tujuan tersebut. Sistem penghantar tali sawat yang digunakan dalam projek ini adalah didorong oleh motor pacuan arus terus (DC) dan model sistem tersebut akan diungkapkan dengan menggunakan persamaan asas matematik. Parameter bagi model tersebut kemudiannya akan dianggarkan menggunakan "*System Identification Toolbox*" yang terkandung dalam perisian Matlab. Untuk tujuan itu, satu eksperimen gelung terbuka akan dilakukan dengan menyuntik isyarat "*Sine*" kepada pemandu motor tersebut untuk mendapatkan data eksperimen bagi proses anggaran. Model yang diperolehi akan digunakan untuk tujuan simulasi. Di dalam projek ini, dua pengawal akan direka. Pengawal PID akan direka untuk memberikan perbandingan kepada pengawal utama iaitu pengawal Kabur Suaian PID. Kedua-dua pengawal yang direka akan disimulasi menggunakan perisian Matlab dan juga akan dilaksanakan pada perkakasan sebenar di mana algoritmanya akan ditulis dalam Pengawal Logik Boleh-aturcara (PLC) menggunakan pengaturcaraan Bahasa Kawalan Berstruktur (SCL). Kedua-dua keputusan simulasi dan eksperimen menunjukkan pengawal Kabur Suaian PID mempunyai prestasi yang lebih baik dan dapat menyesuaikan dengan perubahan beban lebih pantas berbanding pengawal PID. Projek ini juga telah membuktikan bahawa Pengawal Logik Boleh-aturcara mampu melaksanakan aplikasi sistem kawalan tahap tinggi.