APPLICATION OF HARMONY SEARCH ALGORITHM AND PARTICLE SWARM OPTIMIZATION FOR TUNING PROPORTIONAL - DIFFERENTIAL FUZZY CONTROLLER FOR POSITION CONTROL IN PNEUMATIC ACTUATOR

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This project report is submitted in partial of the fulfilment of the requirement for the award of the Master in Electrical Engineering

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JUNE, 2013
This thesis is dedicated to my beloved parent, Mohd Ishak Bin Zakaria and Rohana Bt Mohamad, my wife, Wan Nurul Hani Bt Wan Hasan and not forgotten to all my friend, thank you for the sacrifice and support.

May Allah bless all of you. Amin!
ACKNOWLEDGEMENT

In the name of ALLAH SWT, the most Gracious, who has given me the strength and ability to complete this study. All perfect praises belong to ALLAH SWT, lord of the universe. May His blessing upon the prophet Muhammad SAW and member of his family and companions.

I gratefully acknowledge the co-operation of Dr. Ahmad ‘Athif Bin Mohd Faudzi who has provided me with the reference, guidance, encouragement and support in completing this thesis. All the regular discussion sessions that we had throughout the period of study have contributed to the completion of this project.

Thank you to my classmate and Actuator and Automation Research Group for providing an enjoyable study environment. Finally, I would like to thank my family for their encouragement, support and patience.
Pneumatic actuator system is highly nonlinear and time varying due to many factors such as friction, load variations, air compressibility, dead-time and leakage. Therefore handling and controlling the pneumatic actuator required a specific knowledge and suitable control strategy. In this project, the optimization of pneumatic actuator system which primarily consists of proportional valve and double acting cylinder are presented. The optimization methods that are chose is Harmony Search Algorithm (HSA) which recently introduced and developed and the other one is Particle Swarm Optimization (PSO); population based stochastic optimization technique that inspired by social behaviour of bird flocking or fish schooling. The optimization techniques will be tested by simulation using MATLAB Simulink and then validated by real time experiment. The tracking performances of both techniques are compared and the results show that the HSA provides a better tracking performance compared to the PSO.
ABSTRAK

Sistem penggerak pneumatik adalah tersangat kompleks disebabkan oleh beberapa faktor seperti geseran, perubahan beban, kemampatan cecair, kebocoran dan lain-lain. Oleh itu mengendalikan dan mengawal penggerak pneumatik yang diperlukan pengetahuan tertentu dan strategi kawalan yang sesuai. Projek ini bertujuan mengoptimumkan sistem penggerak pneumatik yang terdiri daripada injap berkadar dan silinder dua tindakan. Kaedah-kaedah pengoptimuman yang dipilih adalah Harmony Search Algorithm (HSA) yang baru dibangun dan diperkenalkan dan yang lain adalah Particle Swamp Optimization (PSO); populasi berdasarkan teknik pengoptimuman stokastik yang diilhamkan oleh tingkah laku sosial burung atau ikan. Teknik-teknik pengoptimuman akan diuji oleh simulasi menggunakan MATLAB Simulink dan kemudian disahkan oleh eksperimen. Prestasi penjejakan kedua-dua teknik dibandingkan dan keputusan menunjukkan bahawa HSA menunjukkan prestasi penjejak yang lebih baik berbanding dengan PSO.