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التوثيق الالكتروني والميكروفيلم

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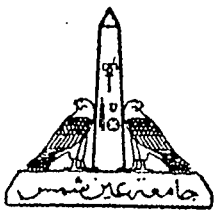

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Department of Power Mechanical

Position Control of Pneumatic Actuator Using Artificial Neural Network

THESIS
Submitted in Partial Fulfillment
Of
The Requirements for The Degree of Master

In
Mechanical Engineering

By
Eng. Badr Eldin Abdel Salam Elsayed

Under Supervision of

Prof. Dr. Ahmed H. Bawady

Dr. Magdy M. Abdel-Hameed Dr. Osama A. Montasser

Cairo
2000

EXAMINERS COMMITTEE

The undersigned certify that they have read and recommend to the Faculty of Engineering, Ain Shams University for acceptance a thesis entitled " **Position Control of Pneumatic Actuator using Artificial Neural Network**", submitted by: Badr Eldin Abdel Salam Elsayed

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STATEMENT

The dissertation is submitted to Ain Shams University for the degree of Master of Science in Mechanical Power Engineering.

The work included in this thesis was carried out by the author in the Mechanical Power Engineering Department, Ain Shams University.

No part of this thesis had been submitted for a degree or qualification at any other University or Institution.

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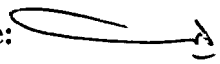
Signature: 

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ABSTRACT

The main issue of this work is to design a proper position control system of a pneumatic system using artificial neural network. The mathematical dynamic model of the pneumatic system is derived. This model indicates that the pneumatic system is highly nonlinear system due to the compressibility of the pressurized air signals, nonlinear flow characteristics through variable area valve orifice and mechanical friction. Also, this model shows that pneumatic systems are of time varying characteristics.

Due to the nonlinearity, a conventional neural network based controller, CNNC, [14] is applied to control the position of the pneumatic system. This controller shows reasonable settling time and less overshooting, but its parameters need to be modified for every input conditions. Therefore a proposed neural network controller, PNNC, is designed and implemented to overcome the disadvantage of the CNNC. The PNN controller is a rule based ANNC where both the slope and amplitude of the actuation function of each neuron is modified to meet all values of the input range. Application of PNN controller yields to a considerable improvement of the system response for different input conditions without changing the initial values of its parameters.

A comparison between the results of proposed rule based neural network controller, PNNC, and a conventional PI

controller shows that the results of the proposed controller is more efficient and robust than that of the PI controller in terms of the system settling time and stability.