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**MODELLING AND CONTROL OF PNEUMATIC ARTIFICIAL MUSCLE
ACTUATOR**

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A Thesis Presented

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Abstract

Pneumatic Artificial Muscle (PAM) actuators yield natural muscle-like actuation with high force to weight ratio, soft and flexible structure, and adaptable compliance for rehabilitation and prosthetic appliances for the disabled as well as humanoid robots in industry. The present study is to develop the empirical models of the PAM actuators in order to both describe and simulate their dynamic behaviours for practical control design and efficient usage. Different characteristics of dynamic behaviour of the PAM actuators are vary from one to another due to not only the structures of the PAM actuators themselves but also the variations of their material properties in manufacturing processes. These inherent complexities still limit the viability of existing analytical models obtained from the physical principles or laws. To overcome the difficulties, the proposed empirical models are experimentally derived from real physical behaviours of the PAM actuators, which are being implemented.

Further, PAM system control is not easy with its high nonlinearity due to its construction and mechanical properties and hence it is difficult to control using linear controllers. Fuzzy logic control is an effective method to handle the nonlinearity of the actuators. The controller is designed by using the data and the models obtained from the PAM system to overcome its controlling difficulties.

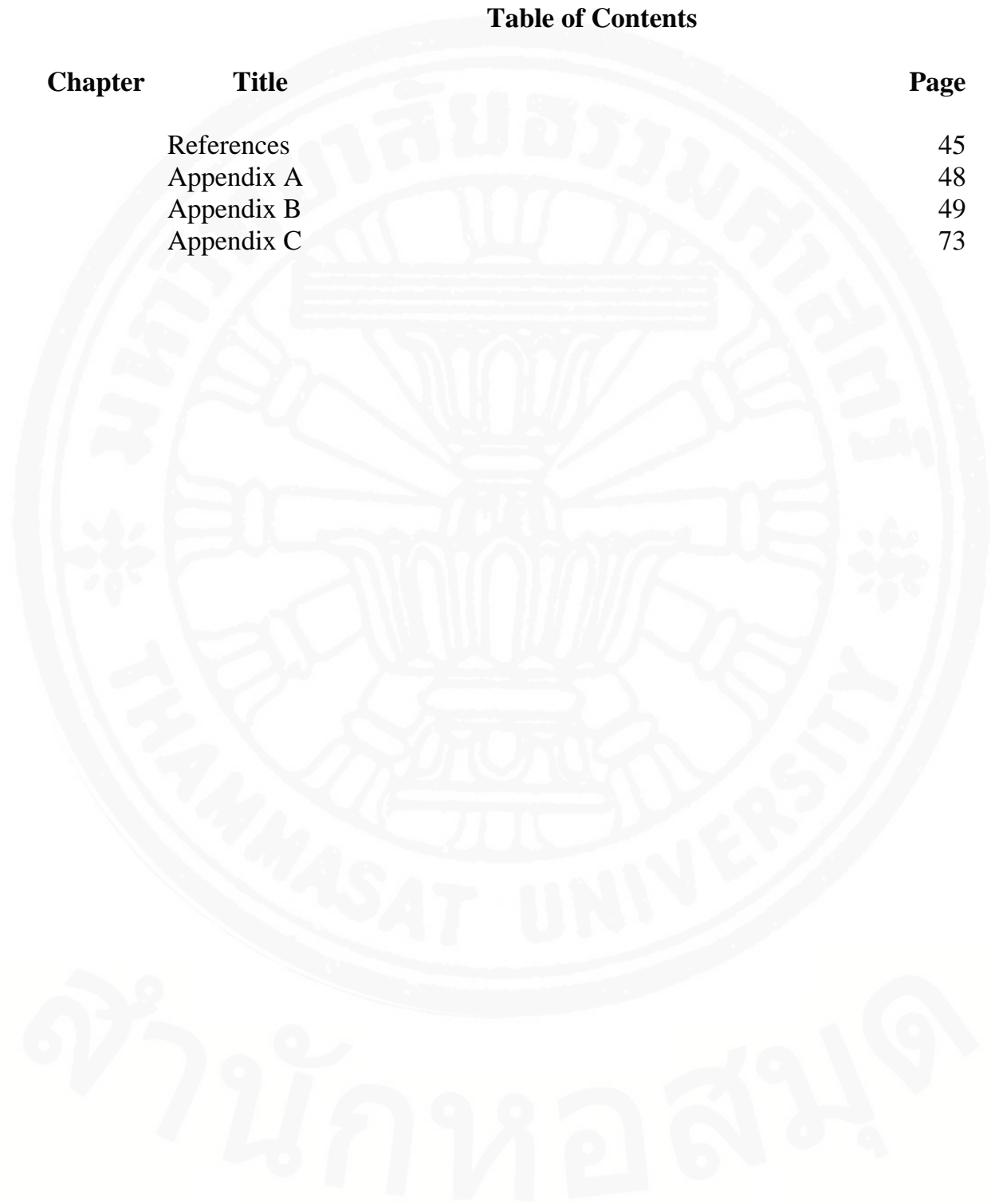
In case studies, the simulation results have good agreement with experimental results, which shows that the proposed methodology can be applied to describe the dynamical behaviours of the real PAM actuators available in industry for effective use and control design.

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