PNEUMATIC ARTIFICIAL MUSCLE CONSTRUCTION USING NATURAL FIBER "SILK" FOR BIO-MEDICAL ENGINEERING

by

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A Thesis

Submitted to the Postgraduate Studies Programme

as a Requirement for the Degree of

MASTER OF SCIENCE

MECHANICAL ENGINEERING DEPARTMENT

UNIVERSITI TEKNOLOGI PETRONAS

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MARCH 2012

ABSTRACT

The objective of this project is to design and develop a desirable low cost and lightweight Pneumatic Artificial Muscle (PAM) actuator using different materials. In this work, the studies are conducted to find the effect of various braided materials such as nylon, steel and Natural Fiber (Silk). The analysis is carried out on actuators of having constant longitudinal length of 140 mm varying the diameter namely 15 mm, 20 mm and 30 mm. The experiment was set up to collect the length and force variation data of the artificial muscle with various compressed air pressures. The force generated by PAM purely depends on the rate of pressure added and removal from the actuator and is contractile in nature upon inflation. PAM actuators find wide applications in various facets of robotic equipments and industrial automation.

They are easy to manufacture, low cost and can be integrated with human operations without any large scale safety requirements. The innovative idea of using silk as braided sleeves has many advantages: It is naturally available with higher stiffness and allowable tensile stress is higher than that of nylon and steel. At a low load actuation of 10 N, the 20 mm diameter the silicon(nylon braided sleeve) actuator contracts 18.45 % , silicon(steel braided sleeve) actuator contracts 20 % and whereas silicon(silk braided sleeve) actuator shows 17.90 % contraction at a inlet pressure of 3 bars. The movement of this actuator is soft which is similar to the human muscle; hence it is preferred for usage in bio medical applications