DEVELOPMENT OF CLOSED LOOP CONTROL FOR LEG EXOSKELETON

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

DEVELOPMENT OF CLOSED LOOP CONTROL
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Technological advancement is very fast. Many of the human problems that used to be impossible to solve, can now be easily solved, with the help of the latest technology. One of these technologies is the exoskeleton. An exoskeleton is an external framework used to assist humans in moving, but such equipment usually requires complex control so that the movements of the exoskeleton follow human movements in general, especially the gait cycle. More specifically, this thesis aims to develop a PID (Proportional-Derivative-Integral) control system for the leg exoskeleton to follow the human gait cycle with good accuracy and fulfill the maximum torque constraint while maintaining a functional and fast-responding system in a one-second cycle. To develop such control system, Lagrange method is used to mathematically model the non-linear system. In this thesis, Genetic Algorithms is used to fine-tune the PID parameter value to fit in the research objective, and a digital signal filter is used to filter any noise created by the system. The designed control system is implemented with the following results, PID control can control the leg exoskeleton to follow human gait with average error per sample 0.03516% for hip and 0.0.0352% for knee, GA can help to find the best PID parameter value for a non-linear system, and signal filtering helps reduce the noise generated by the system.

Keywords: Leg Exoskeleton, Lagrange, PID Control, Genetic Algorithm, Signal Filter, Human Gait

DEDICATION

I dedicate this work to those all people who in needs.

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