

MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah



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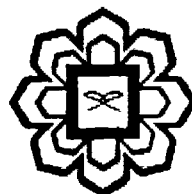
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EDITOR

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Chapter 15

A Review on Control of Two-Wheeled Wheelchair System

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15.1 Introduction

Modeling the standard wheelchair can become very complex if its characteristics close to a real system approximation are to be retained. Transforming a standard four-wheeled wheelchair to a two-wheeled upright wheelchair will result in a highly nonlinear and complex system. This dissertation seeks physical modelling of the wheelchair on two wheels while retaining as many of the characteristics which mimic the double inverted pendulum scenario as possible. Also new architecture of intelligent control strategies are developed and proved that a complex, highly nonlinear system like the two-wheeled wheelchair can be modelled and controlled. Simplicity is maintained with promising results.

The use of wheelchair has become very important for mobility among disabled as well as the aged. In fact it has been tremendously enhanced according to the latest technology and public necessities. It also has been the subject of a great deal of evolution in the wheelchair industry since they were first invented, with particular focus upon wheelchair features and functions including its design, control, style, travel range, suspension system, manoeuvrability, seating and other significant functions. This wheelchair revolution has been encouraged due to the increase in the number of injuries caused by vehicles, rehabilitation enlargement and re-education for an injured person, medical services and need for independence among disabled and elderly as well as the use in sports. Due to the common means of transport the wheelchair possess, some responsible societies have come out with written standard. There are some reports on the details of wheelchair standard have been developed. One of the standards that is important in this research is written in the ISO 7176-5 Wheelchairs: Determination of dimensions and mass [1]. The standard provides the systematic description of wheelchair specifications, environmental issue, surrounding facilities, so that any new version will based on standards. This thesis presents findings of the research carried out on modelling of two-wheeled wheelchair and new architecture of modular intelligent control strategies, involving lifting and stabilizing, wheelchair motion control of backward and forward as well as steering, extension of chair height, as well as the transformation back to normal four-wheeled position. It is hoped that the proposed model, mechanisms and control could be of benefit to a wheelchair user, thus enhancing wheelchair technology for paraplegics and elderly. Since most of the wheelchair users are paraplegics, who are not able to move on their own due to permanent injury in their lower extremities, it will be worth knowing causes of injuries that lead to their dependence on the wheelchair, similarly among the elderly society, who have mobility problems due to their age. The injuries could be caused by accident, falling from a height, or even stroke as described in the next subsection.

There are several reasons for disabled people to use wheelchair [2]. These include the following common injuries;

- a) Cerebral palsy (CP) – It is a brain injury that affects the ability to send motor impulses to the entire body. It can happen during birth, or result from brain trauma