

**UNIVERSITI TEKNOLOGI MARA
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**DEVELOPMENT
OF DYNAMIC MODEL
OF BODY SUPPORTED
KNEE SWING EXERCISE
WITH POWERED ORTHOSIS
FOR LOWERED LIMB
REHABILITATION**

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ABSTRACT

This paper presents the development of body supported knee swing exercise with powered orthosis for lower limb rehabilitation. Knee swing with powered orthosis is subjects in helping stroke patients with gait disorder. This gait disorder is referring to hemiplegia patient. Hemiplegia can be defined as that complete paralysis of half of the body, this term is also similar to hemiparesis which is weakness on one side of the body. This lower limb rehabilitation is modeled in MSC.VisualNastran 4D 2003, and all the knee joint movement are controlled in Matlab/Simulink simulation. The control system was conducted by using PID controller in determining the knee position and the knee angle of a hemiplegia patient for this rehabilitation purpose. The tests were carried out at different gain and without controller at all. Results presented with controller gives more accuracy compared to the system without controller. Stroke rehabilitation is an important part of recovery after stroke and the goal of this program is to help relearn skills that are lost when stroke affected part of the body. Proportional Integral Derivative (PID) controller is used as the controller to control the left side lower limb of humanoid that attached to the knee orthosis by using Matlab/Simulink exportation. By using PID controller, the knee angle movement is becoming smooth as the average trajectory error was reducing compared to the P controller. The comparison of the performance of the stimulated exercise without controller and with PID was evaluated. From the result, a good knee flexion and extension movement was obtain during PID compared to the without controller. This can be approved when the knee flexion will follow the predefined knee trajectory.

Keywords – Stroke Rehabilitation, Knee Swing Powered Orthosis, Body Supported, PID, MSC.VisualNastran, Simulink/MATLAB

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

According to World Health Organization (WHO) in the 1970s stroke was defined as a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours" [1]. While in Malaysia, stroke is determined as the third highest burden of disease that causes death, and also stroke has been declared as top 10 causes for hospitalization[2]. Stroke can happen to anyone at any time, regardless of race, gender or age. In Malaysia, a study conducted by Ministry of Health show that 101 people from the ratio of 1000 population may be suffering from a stroke [3]. Almost 25% of strokes occur in someone who has medical history before or inherits it[4]. Strokes are considered a leading cause of long-term disability where 40% [4]have average to severe deteriorations that require proper care. Stroke occurred when severe blood flow to the brain results in cell death. Stroke suffering patient will go through loss of disability or also can lead to mortality[5]. Each year, worldwide study showed that 15 million people suffered from stroke attack. From these, each of the 5 million people suffering from this disease will die and 5 million more patients become permanently handicapped[6]. In Science studies revealed that there are two main types of stroke which are ischemic, expected to lack of blood flow, and haemorrhagic, that cause by bleeding. Thus result in part of the brain not functioning correctly. Signs and symptoms of a stroke may include an incompetence to move or feel on one side of the body, problems understanding or speaking, feeling like the world is spinning, or loss of vision[7]. If symptoms last less than one or two hours it is known as a transient ischemic attack (TIA)[1]. Stroke rehabilitation is to help survivors become as independent as possible and to gain the most excellent quality of life and in the same time enhance their confidence to face their new world. During