MODEL OF PATHOLOGICAL HUMAN GAIT

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Introduction

The significance of human locomotion to medical personal is knowing the parameters to prevent disabilities in the function of walking. It is important to understand the characteristics of pathological gait for developing functional tools to help patients.

Variations of joint movement patterns are much more noticeable in hemiplegic gait due to the remarkable expression of motion deficit and compensatory movements performed [Chambers, 2002].

The aim of this study is to quantitatively evaluate the abnormal gait by dynamic analysis of the model of hemiplegic gait.

Methods

We studied the motion of a 6 year old child who suffers hemiplegia. In results was observed deviation in degrees in the joint movements of walking over those of the normal [Schwartz, 1947]. The Figure 1 shows the kinematics of the lower limbs for hemiplegic persons, the thick line is the affected limb (left leg), the thin line represents sound leg (right leg), and the gray shade the representation of the normal gait [Peterson].

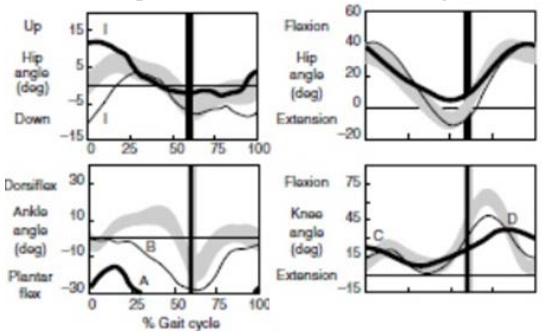

Figure 1: Lower extremity kinematics of a six-year-old child with cerebral palsy and spastic hemiplegia left. Thick lines correspond to the left leg, the thin lines to right leg and gray shadow to normal movement.

Results

From previous normal gait studies, we found the abnormal gait model. We considered hip like reference, and then we build the model of each leg, the floor model and the control model of each joint. Final model is showed in Figure 2.

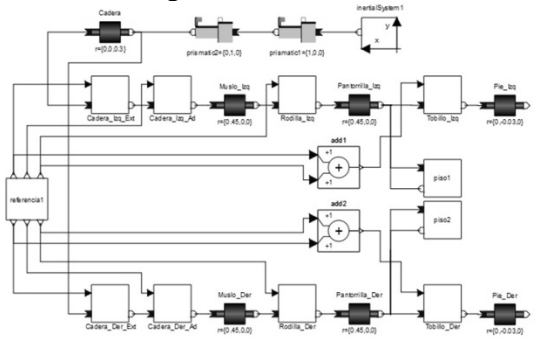

Figure 2: Diagram hemiplegic gait model.

Once designed the whole system of bipedal walking control, we proceeded to make the simulation in Modelica software, graphical behavior getting different joints involved, Figure 3.

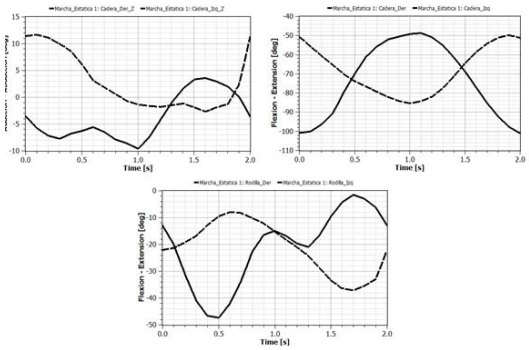

Figure 3: Curves of the hip and knee obtained in simulation.

Discussion

Using models for hemiplegic patients, dynamic analyses were performed on gait. According to previous gait analysis, on the affected limb most of the kinematic parameters showed difference of the normal gait. During the swing phase: hip flexion, knee extension, plantar flexion and circumduction of the leg. During charging: hip flexion, lock knee flexion and plantar flexion. In the mid-stance: knee hyperextension. Difficulty in taking off his toe.

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