



MODELING OF BIPEDAL ROBOT NEGOTIATING SLOPES

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Department of Electrical Engineering, University of Moratuwa
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Degree of Master of Science

by
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Abstract

This research shows how the robotics theories are applied to model the bipedal walking robot. Utilizing the direct kinematics and inverse kinematics, the kinematic model for the robot is developed. The derivation of joint angle equations for 6 links Robot, walking on a slopping surface, is a direct approach in this research. The development of hip trajectory is another important invention specific to this research.

The dynamic stability is analyzed by utilizing ZMP criteria. The calculation of ZMP for this model is very complex and based on mechanics theories. The selection of iteration method to calculate linear accelerations of each link (which are used to calculate ZMP) is guaranteed by simulation results.

The dynamic stability is analyzed for lower body using ZMP simulation results. For this case the "Dynamic" Balance Margin (DBM) is introduced and requirement for stability is also introduced.


The methods or precautions that can be used to improve ZMP are identified. The most effected method for improve the stability is selected as control of torso angle. Finally, the modified ZMP is re-derived with the term of torso angle and it is found that the ZMP can be moved to safe margin by controlling torso angle. The results show the effectiveness of the proposed methodology.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.


It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature


Name of Candidate - M.G.A.P. Abeyratne
Date – 8th February 2010

We/I endorse the declaration by the candidate.

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Name of the Supervisor – Prof. Lanka Udawatta

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