



MODELING OF BIPEDAL ROBOT NEGOTIATING SLOPES

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Department of Electrical Engineering, University of Moratuwa
in partial fulfilment of the requirements for the
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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Contents

Declaration	i
Abstract	iv
Acknowledgement	v
List of Figures	vi
List of Tables	vii
Chapters	
1. Introduction	1
1.1 General introduction to robotics	1
1.1.1 What is and what is not a robot	2
1.1.2 Laws of robotics	4
1.1.3 Robotic anatomy	4
1.1.4 Robot applications	5
1.2 Robot locomotion	6
1.2.1 Key issues of locomotion	8
1.3 Legged mobile robot	8
1.3.1 Leg configuration and stability	9
1.3.2 Biped robot	9
1.3.3 Biped walking	9
1.4 Research objectives	11
1.5 Overview	11
2. Literature review and Problem Statement	12
2.1 Literature Review	12
2.2 Problem Statement	16
2.2.1 Preliminaries	16
2.2.2 Problem Identification	16
2.2.3 New suggestions	16
3. Swing leg kinematics for Biped robot	17
3.1 Preliminaries	17
3.1.1 Manipulator kinematics	17
3.1.2 Link descriptions	17
3.1.3 Link parameters	19
3.1.4 Derivation of link transformations	20
3.1.5 Concatenating link transformations	21
3.2 Derivation of joint angle equation for swing leg	22
3.2.1 Derivation of equation for joint angle θ_2	24
3.2.2 Derivation of equation for joint angle θ_1	25
4. Gait development	26
4.1 Intuitive approach	27
4.2 Periodic function approach	27
4.3 Foot trajectory	28
5. Stance leg kinematics	29
5.1 Stance leg modeling	29
5.2 Mathematical modeling	29

5.2.1	DH parameters for stance leg	29
5.2.2	Link transformation, homogeneous transformation and End effector matrices for stance leg	30
5.2.3	Derivation of joint angle equations	31
5.3	Modification of swing leg kinematics	32
5.3.1	Trajectory planning of hip	33
5.3.2	Rimless wheel simulation	33
5.3.3	Calculation of hip movement	34
6.	Dynamic stability analysis for lower body	35
6.1	Methods for stability analysis of bipedal robots	35
6.1.1	Zero moment position	35
6.2	ZMP calculation for lower body	38
6.2.1	Calculation of inertia term	38
6.2.2	Calculation of angular acceleration term	39
6.2.3	Finding of mass-centre coordinates	41
6.3	Calculation of individual link accelerations	42
6.3.1	Newton Euler formulation	42
6.3.2	Kinematics of links	44
6.3.3	Link accelerations	45
6.3.4	Recursive Newton Euler formulation	45
6.3.5	Forward iteration	46
6.4	Application of NE recursive iteration to biped robot	48
6.4.1	NE forward iteration for swing leg	48
6.4.2	NE forward recursive iteration for stance leg	53
6.5	Dynamic stability analysis for robot lower body	56
6.5.1	Dynamic balance margin	56
6.5.2	Simulation result on stability- Robot lower body	57
7.	ZMP calculation after adding torso	59
7.1	Modification of ZMP	59
7.1.1	Method for improving the ZMP	59
7.2	Calculation of improved ZMP	59
7.2.1	Calculation of linear acceleration terms	60
7.3	Stability Analysis from simulation results	62
7.3.1	ZMP variation with slope angle	63
7.3.2	ZMP variation with step length	64
7.3.3	ZMP variation with mass of torso	66
7.3.4	ZMP variation with torso angle	66
7.3.5	Variation of ZMP with step time	67
7.3.6	ZMP variation with link length L_1 and L_2	67
7.4	Application of simulation results	68
8.	Conclusion	69
8.1	Derived kinematic model	69
Future work		70
References		71

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List of Figures

Figure	Page
1.1 Picture of auto assembly plant- Spot welding robot KUKA	1
1.2 An industrial robot that least looks like a human	2
1.3 The base, arm, wrist, and end-effector forming the mechanical structure of a manipulator	4
1.4 Approximated bipedal walking system	7
1.5 Stability in static walking	10
2.1 A photograph of shadow biped robot	15
2.2 A photograph of wabian robot	15
3.1 Relationship of link length and link twist	18
3.2 Parameters used to describe the connecting between neighbouring links	19
3.3 Attachment of frame $\{i\}$ rigidly to the link i	20
3.4 Robot lower body and nomenclature	22
4.1 Illustration of the gait cycle and dynamic biped walking	26
5.1 Stance leg and nomenclature	29
5.2 Robot lower body with moving hip	32
5.3 The simulation of rimless wheel	33
6.1 Single support phase	35
6.2 The velocity distribution of swing leg	40
6.3 Mass centre coordinates of each link	41
6.4 The geometry and kinematics of link i for NE formulation	42
6.5 Characterization of two adjutant links forming the joint i for NE formulation	44
6.6 Two-pass recursive NE formulation of dynamic equation	46
6.7 Initial position of the swing leg	48
6.8 Initial and final position of the stance leg during one gait cycle	53
6.9 DBM for single support phase	56
6.10 DBM for double support phase	57
6.11 Variation of ZMP vs time of lower body for one gait cycle	58
7.1 Variation of ZMP with torso angle at slope angle equal to 5°	63
7.2 Variation of ZMP with torso angle at slope angle equal to 10°	63
7.3 Variation of ZMP with torso angle at slope angle equal to 15°	64
7.4 ZMP variation with torso angle when step length is 700mm	64
7.5 ZMP variation with torso angle when step length is 350mm	65
7.6 ZMP variation with torso angle when step length is 150mm	65
7.7 Variation of ZMP with different values of torso weight	66
7.8 Variation of ZMP for different values of torso length	66
7.9 Variation of ZMP with different step time intervals	67
7.10 Variation of ZMP with different values of L_1 and L_2	67

List of Tables

Table	Page
3.1 DH parameters of swing leg	22
5.1 DH parameters of stance leg	30
7.1 Selected physical parameters for simulation	58
7.1 Physical parameters for simulation 1	63
7.2 Physical parameters for simulation 2	63
7.3 Physical parameters for simulation 3	64
7.4 Physical parameters for simulation 4	64
7.5 Physical parameters for simulation 5	65
7.6 Physical parameters for simulation 6	65
7.7 Physical parameters for simulation 7	66
7.8 Physical parameters for simulation 8	66
7.9 Physical parameters for simulation 9	67
7.10 Physical parameters for simulation 10	67



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