



# Motion Planning For Humanoid Robots

**Mohammed M. Elmogy, Christopher  
Habel, Jianwei Zhang**



## **Motion Planning For Humanoid Robots:**

**Motion Planning for Humanoid Robots** Kensuke Harada, Eiichi Yoshida, Kazuhito Yokoi, 2010-08-12 Research on humanoid robots has been mostly with the aim of developing robots that can replace humans in the performance of certain tasks Motion planning for these robots can be quite difficult due to their complex kinematics dynamics and environment It is consequently one of the key research topics in humanoid robotics research and the last few years have witnessed considerable progress in the field Motion Planning for Humanoid Robots surveys the remarkable recent advancement in both the theoretical and the practical aspects of humanoid motion planning Various motion planning frameworks are presented in Motion Planning for Humanoid Robots including one for skill coordination and learning and one for manipulating and grasping tasks The problem of planning sequences of contacts that support acyclic motion in a highly constrained environment is addressed and a motion planner that enables a humanoid robot to push an object to a desired location on a cluttered table is described The main areas of interest include whole body motion planning task planning biped gait planning and sensor feedback for motion planning Torque level control of multi contact behavior autonomous manipulation of moving obstacles and movement control and planning architecture are also covered Motion Planning for Humanoid Robots will help readers to understand the current research on humanoid motion planning It is written for industrial engineers advanced undergraduate and postgraduate students

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[Motion and Operation Planning of Robotic Systems](#) Giuseppe Carbone, Fernando Gomez-Bravo, 2015-03-12 This book addresses the broad multi disciplinary topic of robotics and presents the basic techniques for motion and operation planning in robotics systems Gathering

contributions from experts in diverse and wide ranging fields it offers an overview of the most recent and cutting edge practical applications of these methodologies It covers both theoretical and practical approaches and elucidates the transition from theory to implementation An extensive analysis is provided including humanoids manipulators aerial robots and ground mobile robots Motion and Operation Planning of Robotic Systems addresses the following topics The theoretical background of robotics Application of motion planning techniques to manipulators such as serial and parallel manipulators Mobile robots planning including robotic applications related to aerial robots large scale robots and traditional wheeled robots Motion planning for humanoid robots An invaluable reference text for graduate students and researchers in robotics this book is also intended for researchers studying robotics control design user interfaces modelling simulation sensors humanoid robotics

**Motion Planning for Legged and Humanoid Robots** Kris Hauser,2008 *Motion Planning for Legged and Humanoid Robots* Kris Hauser (College teacher),2008 **Motion Planning** Claudia Elvira Esteves Jaramillo,2007 The goal of this thesis is to develop motion planning algorithms for human like figures that take into account the geometry kinematics and dynamics of the mechanism and its environment We propose a three stage strategy to solve the problem of generating motions for human like figures that manipulate bulky objects while walking In the process several interesting problems and their solutions are brought into focus These problems are 3D collision avoidance two hand object manipulation cooperative manipulation among several characters or robots and the combination of different behaviors Our main contribution is the modeling of the automatic generation of cooperative manipulation motions This model considers the above difficulties all in the context of bipedal walking mechanisms The motion planner connected to different controllers is used and tested in different mechanisms both virtual and physical

**Online Motion Planning for Hoap-2 Humanoid Robot Navigation** Mohammed M. Elmogy,Christopher Habel,Jianwei Zhang,2015 Autonomous robot navigation is becoming an increasingly important research topic for mobile robots In the last few years significant progress has been made towards stable robotic bipedal walking This is creating an increased research interest in developing autonomous navigation strategies which are tailored specifically to humanoid robots Efficient approaches to perception and motion planning which are suited to the unique characteristics of biped humanoid robots and their typical operating environments are receiving special interest In this paper we present a time efficient motion planning system for a Fujitsu HOAP 2 humanoid robot The sampling based algorithm is used to provide the robot with minimal free configuration space which is sampled to extract the robot path For collision detection a cylinder model is used to approximate the trajectory for the body center of the humanoid robot during navigation It calculates the actual distances required to execute different actions of the robot and compares them with the distances to the nearest obstacles The A search algorithm is then implemented to find smooth and low cost footstep placements of the humanoid robot within the resulting configuration space The proposed hybrid algorithm reduces searching time and produces a smoother path for the humanoid robot at a low cost Integrating Perception and Planning for

Humanoid Autonomy Philipp Michel,2008 Abstract Today s agile humanoid robots are testament to the impressive advances in the design of biped mechanisms and control in recent robotics history The big challenge however remains to properly exploit the generality and flexibility of humanoid platforms during fully autonomous operation in obstacle filled and dynamically changing environments Increasing effort has thus been focused on the challenges arising for perception and motion planning as well as the interplay between both as foundations of humanoid autonomy This thesis explores appropriate approaches to perception on humanoids and ways of coupling sensing and planning to generate navigation and manipulation strategies that can be executed reliably We investigate perception methods employing on and off body sensors that are combined with an efficient motion planner to allow the humanoid robot HRP 2 and Honda s ASIMO to traverse complex and unpredictably changing environments We examine how predictive information about the future state of the world gathered from observation enables navigation in the presence of challenging moving obstacles We show how programmable graphics hardware can be exploited to create a novel model based 3D tracking system able to robustly address the difficulties of real time sensing specifically encountered on a locomoting humanoid This thesis argues furthermore that reliability of autonomous operation can be improved by reasoning about perception during the planning process rather than maintaining the traditional separation of the sensing and planning stages We use the humanoid robots ARMAR III and HRP 2 to investigate and validate such planning for perceptive capability in manipulation and navigation scenarios While humanoid robots serve as the motivating challenge and application domain for this thesis much of the resulting work is general in nature and has applications in other areas of robotics and computer vision *Time Efficient Hybrid Motion Planning Algorithm for Hoap-2 Humanoid Robot* Mohammed M. Elmogy,Christopher Habel,Jianwei Zhang,2015 The development of practical motion planning algorithms and obstacle avoidance techniques is considered as one of the most important fields of study in the task of building autonomous or semiautonomous robot systems The motion planners designed for humanoid robots combine both path planning generation and the ability of executing the resulting path with respect to their characteristics These planners should consider the specific dynamical constraints and stability problems of the humanoid robots In this paper we present a time efficient hybrid motion planning system for a Fujitsu HOAP 2 humanoid robot in indoor and miniature city environments The proposed technique is a combination of sampling based planner and D Lite search to generate dynamic footstep placements in unknown environments It generates the search space depending on non uniform sampling of the free configuration space to direct the computational resources to troubled and difficult regions D Lite search is then implemented to find dynamic and low cost footstep placements within the resulting configuration space The proposed hybrid algorithm reduces the searching time and produces a smoother path for the humanoid robot with low cost **Synchronized Leg-arm Motion Planning and Whole-body Momentum Control for Humanoid Robots** □□ □,2018 *Mobile Robots Navigation* Alejandra Barrera,2010-03-01 Mobile robots navigation includes different interrelated

activities i perception as obtaining and interpreting sensory information ii exploration as the strategy that guides the robot to select the next direction to go iii mapping involving the construction of a spatial representation by using the sensory information perceived iv localization as the strategy to estimate the robot position within the spatial map v path planning as the strategy to find a path towards a goal location being optimal or not and vi path execution where motor actions are determined and adapted to environmental changes The book addresses those activities by integrating results from the research work of several authors all over the world Research cases are documented in 32 chapters organized within 7 categories next described

*Intelligent Robotics and Applications* Huayong Yang, Honghai Liu, Jun Zou, Zhouping Yin, Lianqing Liu, Geng Yang, Xiaoping Ouyang, Zhiyong Wang, 2023-10-10 The 9 volume set LNAI 14267 14275 constitutes the proceedings of the 16th International Conference on Intelligent Robotics and Applications ICIRA 2023 which took place in Hangzhou China during July 5 7 2023 The 413 papers included in these proceedings were carefully reviewed and selected from 630 submissions They were organized in topical sections as follows Part I Human Centric Technologies for Seamless Human Robot Collaboration Multimodal Collaborative Perception and Fusion Intelligent Robot Perception in Unknown Environments Vision Based Human Robot Interaction and Application Part II Vision Based Human Robot Interaction and Application Reliable AI on Machine Human Reactions Wearable Sensors and Robots Wearable Robots for Assistance Augmentation and Rehabilitation of Human Movements Perception and Manipulation of Dexterous Hand for Humanoid Robot Part III Perception and Manipulation of Dexterous Hand for Humanoid Robot Medical Imaging for Biomedical Robotics Advanced Underwater Robot Technologies Innovative Design and Performance Evaluation of Robot Mechanisms Evaluation of Wearable Robots for Assistance and Rehabilitation 3D Printing Soft Robots Part IV 3D Printing Soft Robots Dielectric Elastomer Actuators for Soft Robotics Human like Locomotion and Manipulation Pattern Recognition and Machine Learning for Smart Robots Part V Pattern Recognition and Machine Learning for Smart Robots Robotic Tactile Sensation Perception and Applications Advanced Sensing and Control Technology for Human Robot Interaction Knowledge Based Robot Decision Making and Manipulation Design and Control of Legged Robots Part VI Design and Control of Legged Robots Robots in Tunnelling and Underground Space Robotic Machining of Complex Components Clinically Oriented Design in Robotic Surgery and Rehabilitation Visual and Visual Tactile Perception for Robotics Part VII Visual and Visual Tactile Perception for Robotics Perception Interaction and Control of Wearable Robots Marine Robotics and Applications Multi Robot Systems for Real World Applications Physical and Neurological Human Robot Interaction Part VIII Physical and Neurological Human Robot Interaction Advanced Motion Control Technologies for Mobile Robots Intelligent Inspection Robotics Robotics in Sustainable Manufacturing for Carbon Neutrality Innovative Design and Performance Evaluation of Robot Mechanisms Part IX Innovative Design and Performance Evaluation of Robot Mechanisms Cutting Edge Research in Robotics

**Advances in Climbing and Walking Robots** Ming Xie, 2007 Robotics is an exciting field in engineering and natural sciences Robotics has

already made a significant contribution to many industries with the widespread use of industrial robots for tasks such as assembly welding painting and handling materials In parallel we have witnessed the emergence of special robots which can undertake assistive jobs such as search and rescue de mining surveillance exploration and security functions Indeed the interest in mobile machines such as climbing and walking robots has broadened the scope of investigation in robotics This volume covers broad topics related to mobile machines in general and climbing and walking robots in particular Papers from the following keynote speakers are included Heinz Worn University of Karlsruhe Germany Atsuo Takanishi University of Waseda Japan John Billingsley University of Southern Queensland Australia Bryan Bridge London South Bank University UK and Neville Hogan Massachusetts Institute of Technology USA

**Humanoid Robots** Armando Carlos De Pina Filho,2007-06-01 For many years the human being has been trying in all ways to recreate the complex mechanisms that form the human body Such task is extremely complicated and the results are not totally satisfactory However with increasing technological advances based on theoretical and experimental researches man gets in a way to copy or to imitate some systems of the human body These researches not only intended to create humanoid robots great part of them constituting autonomous systems but also in some way to offer a higher knowledge of the systems that form the human body objectifying possible applications in the technology of rehabilitation of human beings gathering in a whole studies related not only to Robotics but also to Biomechanics Biomimetics Cybernetics among other areas This book presents a series of researches inspired by this ideal carried through by various researchers worldwide looking for to analyze and to discuss diverse subjects related to humanoid robots The presented contributions explore aspects about robotic hands learning language vision and locomotion

*Computational Intelligence and Bioengineering* Francesco Masulli,Alessio Micheli,Alessandro Sperduti,2009 This volume presented during a symposium in memory of Antonina Starita which was held in Pisa at the Department of Computer Science Pref

**Motion Planning for Human-robot Cooperative Tasks** Max L. Gilbert,2017 Intelligent Autonomous Systems 9 Tamio Arai,2006 Autonomy and adaptivity are key aspects of truly intelligent artificial systems dating from the first IAS conference in 1989 The goal of IAS 9 is to lay out scientific ideas and design principles for artificial systems This work contains papers that cover both the applied and the theoretical aspects of intelligent autonomous systems

Machine Tool Technology, Mechatronics and Information Engineering Zhong Min Wang,Dong Fang Yang,Kun Yang,Liang Yu Guo,Jian Ming Tan,2014-09-22 Selected peer reviewed papers from the 2014 International Conference on Machine Tool Technology and Mechatronics Engineering ICMTTME 2014 June 22 23 2014 Guilin Guangxi China

**Robotics Research** Henrik I. Christensen,Oussama Khatib,2016-08-25 This volume presents a collection of papers presented at the 15th International Symposium of Robotic Research ISRR ISRR is the biennial meeting of the International Foundation of Robotic Research IFRR and its 15th edition took place in Flagstaff Arizona on December 9 to December 12 2011 As for the previous symposia ISRR 2011 followed up on the successful concept of a mixture of invited contributions and open submissions

Therefore approximately half of the 37 contributions were invited contributions from outstanding researchers selected by the IFRR officers and the program committee and the other half were chosen among the open submissions after peer review This selection process resulted in a truly excellent technical program which featured some of the very best of robotic research The program was organized around oral presentation in a single track format and included for the first time a small number of interactive presentations The symposium contributions contained in this volume report on a variety of new robotics research results covering a broad spectrum including perception manipulation grasping vehicles and design navigation control and integration estimation and SLAM

**Proceedings of the ... ASME Design Engineering Technical Conferences ,2006**

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