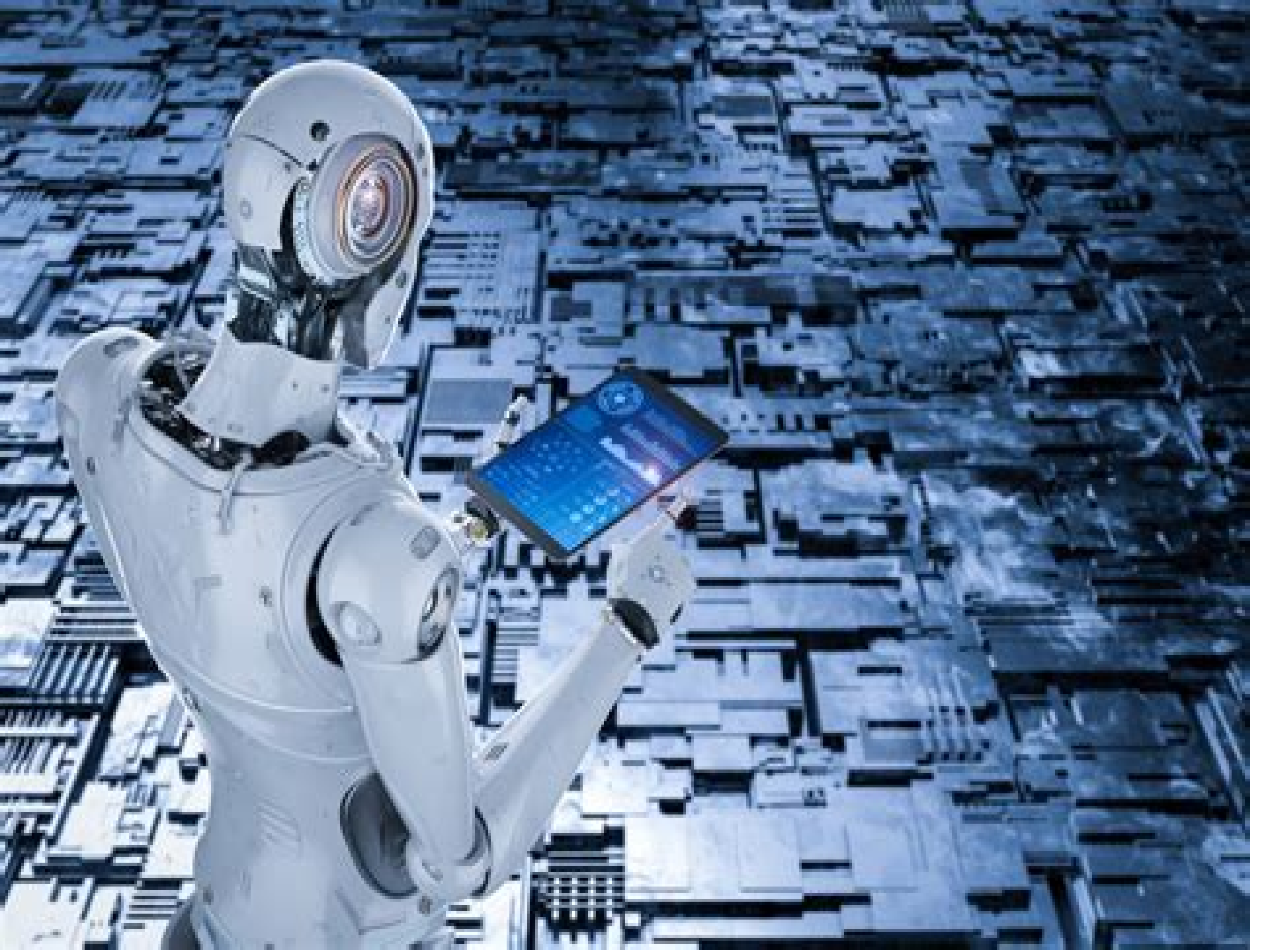

Motion Planning For Humanoid Robots

Huayong Yang,Honghai Liu,Jun Zou,Zhouping Yin,Lianqing Liu,Geng Yang,Xiaoping Ouyang,Zhiyong Wang

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 *Motion Planning for Humanoid Robots* Kensuke Harada,Eiichi Yoshida,Kazuhito Yokoi,2011-03-25 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 *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 **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 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 **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 objets 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 *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

Robot Motion Planning Jean-Claude Latombe,2012-12-06 One of the ultimate goals in Robotics is to create autonomous robots Such robots will accept high level descriptions of tasks and will execute them without further human intervention The

input descriptions will specify what the user wants done rather than how to do it The robots will be any kind of versatile mechanical device equipped with actuators and sensors under the control of a computing system Making progress toward autonomous robots is of major practical inter est in a wide variety of application domains including manufacturing construction waste management space exploration undersea work as sistance for the disabled and medical surgery It is also of great technical interest especially for Computer Science because it raises challenging and rich computational issues from which new concepts of broad useful ness are likely to emerge Developing the technologies necessary for autonomous robots is a formidable undertaking with deep interweaved ramifications in auto mated reasoning perception and control It raises many important prob lems One of them motion planning is the central theme of this book It can be loosely stated as follows How can a robot decide what motions to perform in order to achieve goal arrangements of physical objects This capability is eminently necessary since by definition a robot accomplishes tasks by moving in the real world The minimum one would expect from an autonomous robot is the ability to plan its x Preface own motions **Combining Dense and Sparse Data for Real-time SLAM and Motion Planning on Humanoid Robot** René Wagner,2021 *Motion Planning for Human-robot Cooperative Tasks* Max L. Gilbert,2017 **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 **Humanoid Robots** Dragomir N. Nenchev,Atsushi Konno,Teppei Tsujita,2018-11-21 Humanoid Robots Modeling and Control provides systematic presentation of the models used in the analysis design and control of humanoid robots The book starts with a historical overview of the field a summary of the current state of the art achievements and an outline of the related fields of research It moves on to explain the theoretical foundations in terms of kinematic kineto static and dynamic relations Further on a detailed overview of biped balance control approaches is presented Models and control algorithms for cooperative object manipulation with a multi finger hand a dual arm and a multi robot system are also discussed One of the chapters is devoted to selected topics from the area of motion generation and control and their applications The final chapter focuses on simulation environments specifically on the step by step design of a simulator using the Matlab environment and tools This book will benefit readers with an advanced level of understanding of robotics mechanics and control such as graduate students academic and industrial researchers and professional engineers Researchers in the related fields of multi legged robots biomechanics physical therapy and physics

based computer animation of articulated figures can also benefit from the models and computational algorithms presented in the book Provides a firm theoretical basis for modelling and control algorithm design Gives a systematic presentation of models and control algorithms Contains numerous implementation examples demonstrated with 43 video clips Robotics Research Paolo Dario,Raja Chatila,2005-08-24 ISRR the International Symposium on Robotics Research is one of robotics pioneering symposia which has established some of the field s most fundamental and lasting contributions over the past two decades This book presents the results of the eleventh edition of Robotics Research ISRR03 offering a broad range of topics in robotics The contributions provide a wide coverage of the current state of robotics research the advances and challenges in its theoretical foundation and technology basis and the developments in its traditional and new emerging areas of applications The diversity novelty and span of the work unfolding in these areas reveal the field s increased maturity and expanded scope and define the state of the art of robotics and its future direction **Robotics Research** Paolo Dario,Raja Chatila,2005-02-17 ISRR the International Symposium on Robotics Research is one of robotics pioneering symposia which has established some of the field s most fundamental and lasting contributions over the past two decades This book presents the results of the eleventh edition of Robotics Research ISRR03 offering a broad range of topics in robotics The contributions provide a wide coverage of the current state of robotics research the advances and challenges in its theoretical foundation and technology basis and the developments in its traditional and new emerging areas of applications The diversity novelty and span of the work unfolding in these areas reveal the field s increased maturity and expanded scope and define the state of the art of robotics and its future direction *Robot Motion Planning with Contact from Global Pseudo-inverse Map* Changrak Choi,2018 In the robot motion planning problems environment and its objects are often treated as obstacles to be avoided However there are situations where contacting with the environment is not costly Moreover in many cases making contact can actually help a robot to maneuver around to reach a goal state which would not have been possible otherwise This thesis presents a framework for motion planner that utilizes multiple contacts with the environment and its objects The planner is targeted to autonomously generate motion where robot has to make multiple contact with different part of its body in order to achieve a task objective It is motivated by and has significance in developing a robust humanoid planner that is capable of recovering from a fall down The recent DRC has been marked with compilation of humanoid robots falling down but only one robot managed to recover to a standing up position In a real disaster scenario the inability to stand up would mean end of the rescue mission for what is extremely expensive machinery A robust planner capable of recovery is must and this work contributes towards it The developed planner autonomously generates standing up motion from fall down in the presence of torque limits The proposed multi contact motion planner leverages upon following two key components Existing multi contact planners require good initial seeds to successfully generate a motion These are hard to find and often manually encoded Here we utilize pre computed global pseudo inverse map inverse kinematic map for each contact state that has

property of global resolution connected by connectivity functions to generate multi contact motion from current configuration to the goal without need for an initial seed Nevertheless constructing the global pseudo inverse map is computationally expensive In an effort to facilitate the construction we utilize singular configurations as a heuristic to reduce the search space and justify its use based on the physical analysis Although computationally expensive once pre computed the global map can be used to generate plans fast online in a multi query manner *Motion Planning Using Synergies : Application to Anthropomorphic Dual-arm Robots* Néstor García Hidalgo,2019 Motion planning is a traditional field in robotics but new problems are nevertheless incessantly appearing due to continuous advances in the robot developments In order to solve these new problems as well as to improve the existing solutions to classical problems new approaches are being proposed A paradigmatic case is the humanoid robotics since the advances done in this field require motion planners not only to look efficiently for an optimal solution in the classic way i e optimizing consumed energy or time in the plan execution but also looking for human like solutions i e requiring the robot movements to be similar to those of the human beings This anthropomorphism in the robot motion is desired not only for aesthetical reasons but it is also needed to allow a better and safer human robot collaboration humans can predict more easily anthropomorphic robot motions thus avoiding collisions and enhancing the collaboration with the robot Nevertheless obtaining a satisfactory performance of these anthropomorphic robotic systems requires the automatic planning of the movements which is still an arduous and non evident task since the complexity of the planning problem increases exponentially with the number of degrees of freedom of the robotic system This doctoral thesis tackles the problem of planning the motions of dual arm anthropomorphic robots optionally with mobile base The main objective is twofold obtaining robot motions both in an efficient and in a human like fashion at the same time Trying to mimic the human movements while reducing the complexity of the search space for planning purposes leads to the concept of synergies which could be conceptually defined as correlations in the joint configuration space as well as in the joint velocity space between the degrees of freedom of the system This work proposes new sampling based motion planning procedures that exploit the concept of synergies both in the configuration and velocity space coordinating the movements of the arms the hands and the mobile base of mobile anthropomorphic dual arm robots

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 *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

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