

# Qualitative Motion Understanding

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Qualitative Motion Understanding

# Qualitative Motion Planning

**Zexiang Li, J.F. Canny**



## **Qualitative Motion Planning:**

**Spatial Reasoning and Planning** Jiming Liu, Laeeque K. Daneshmend, 2012-12-06 Spatial reasoning and planning is a core constituent in robotics graphics computer aided design and geographic information systems After a review of previous work in the related areas Liu and Daneshmend present here a unified framework for qualitative spatial representation and reasoning which enables the generation of solutions to spatial problems where the geometric knowledge is imprecise The approach utilizes qualitative spatial representation and reasoning integrated with a quantitative search procedure based on simulated annealing Many graphical illustrations and detailed algorithm descriptions help the readers to comprehend the solution paths and to develop their own applications The book is written as a self contained text for researchers and graduate students in computer science and related engineering disciplines The methodologies algorithmic details and case studies presented can be used as course material as well as a convenient reference Nonholonomic Motion Planning Zexiang Li, J.F. Canny, 2012-12-06 Nonholonomic Motion Planning grew out of the workshop that took place at the 1991 IEEE International Conference on Robotics and Automation It consists of contributed chapters representing new developments in this area Contributors to the book include robotics engineers nonlinear control experts differential geometers and applied mathematicians Nonholonomic Motion Planning is arranged into three chapter groups Controllability one of the key mathematical tools needed to study nonholonomic motion Motion Planning for Mobile Robots in this section the papers are focused on problems with nonholonomic velocity constraints as well as constraints on the generalized coordinates Falling Cats Space Robots and Gauge Theory there are numerous connections to be made between symplectic geometry techniques for the study of holonomies in mechanics gauge theory and control In this section these connections are discussed using the backdrop of examples drawn from space robots and falling cats reorienting themselves Nonholonomic Motion Planning can be used either as a reference for researchers working in the areas of robotics nonlinear control and differential geometry or as a textbook for a graduate level robotics or nonlinear control course Motion Planning Xj Jing, 2008-06-01 In this book new results or developments from different research backgrounds and application fields are put together to provide a wide and useful viewpoint on these headed research problems mentioned above focused on the motion planning problem of mobile robots These results cover a large range of the problems that are frequently encountered in the motion planning of mobile robots both in theoretical methods and practical applications including obstacle avoidance methods navigation and localization techniques environmental modelling or map building methods and vision signal processing etc Different methods such as potential fields reactive behaviours neural fuzzy based methods motion control methods and so on are studied Through this book and its references the reader will definitely be able to get a thorough overview on the current research results for this specific topic in robotics The book is intended for the readers who are interested and active in the field of robotics and especially for those who want to study and develop their own methods in motion path planning or control for an

intelligent robotic system      **Using Qualitative Spatial Reasoning in Projectile Motion Planning** Robert Kracik, 1991

Advances in Artificial Intelligence: From Theory to Practice Salem Benferhat, Karim Tabia, Moonis Ali, 2017-06-10 The two volume set LNCS 10350 and 10351 constitutes the thoroughly refereed proceedings of the 30th International Conference on Industrial Engineering and Other Applications of Applied Intelligent Systems IEA AIE 2017 held in Arras France in June 2017 The 70 revised full papers presented together with 45 short papers and 3 invited talks were carefully reviewed and selected from 180 submissions They are organized in topical sections constraints planning and optimization data mining and machine learning sensors signal processing and data fusion recommender systems decision support systems knowledge representation and reasoning navigation control and autonome agents sentiment analysis and social media games computer vision and animation uncertainty management graphical models from theory to applications anomaly detection agronomy and artificial intelligence applications of argumentation intelligent systems in healthcare and mhealth for health outcomes and innovative applications of textual analysis based on AI      *Motion Planning for Autonomous Vehicles in Partially Observable Environments* Taş, Ömer Şahin, 2023-10-23 This work develops a motion planner that compensates the deficiencies from perception modules by exploiting the reaction capabilities of a vehicle The work analyzes present uncertainties and defines driving objectives together with constraints that ensure safety The resulting problem is solved in real time in two distinct ways first with nonlinear optimization and secondly by framing it as a partially observable Markov decision process and approximating the solution with sampling

**The Complexity of Robot Motion Planning** John Canny, 1988 The Complexity of Robot Motion Planning makes original contributions both to robotics and to the analysis of algorithms In this groundbreaking monograph John Canny resolves long standing problems concerning the complexity of motion planning and for the central problem of finding a collision free path for a jointed robot in the presence of obstacles obtains exponential speedups over existing algorithms by applying high powered new mathematical techniques Canny's new algorithm for this generalized movers problem the most studied and basic robot motion planning problem has a single exponential running time and is polynomial for any given robot The algorithm has an optimal running time exponent and is based on the notion of roadmaps one dimensional subsets of the robot's configuration space In deriving the single exponential bound Canny introduces and reveals the power of two tools that have not been previously used in geometrical algorithms the generalized multivariable resultant for a system of polynomials and Whitney's notion of stratified sets He has also developed a novel representation of object orientation based on unnormalized quaternions which reduces the complexity of the algorithms and enhances their practical applicability After dealing with the movers problem the book next attacks and derives several lower bounds on extensions of the problem finding the shortest path among polyhedral obstacles planning with velocity limits and compliant motion planning with uncertainty It introduces a clever technique path encoding that allows a proof of NP hardness for the first two problems and then shows that the general form of compliant motion planning a problem that is

the focus of a great deal of recent work in robotics is non deterministic exponential time hard Canny proves this result using a highly original construction John Canny received his doctorate from MIT And is an assistant professor in the Computer Science Division at the University of California Berkeley The Complexity of Robot Motion Planning is the winner of the 1987 ACM Doctoral Dissertation Award

**Computer Graphics And Applications - Proceedings Of The First Pacific Conference On Computer Graphics And Applications, Pacific Graphics '93** S Y Shin, Tosiyasu L Kunii, 1993-08-06 This volume of proceedings contains papers by computer graphics researchers developers and practitioners The papers report on the latest advances and new ideas in computer graphics They also discuss future directions in the field The volume reflects the aim of the conference to promote computer graphics research activities in the Pacific region

*Readings in Qualitative Reasoning About Physical Systems* Daniel S. Weld, Johan De Kleer, 2013-09-17 *Readings in Qualitative Reasoning about Physical Systems* describes the automated reasoning about the physical world using qualitative representations This text is divided into nine chapters each focusing on some aspect of qualitative physics The first chapter deal with qualitative physics which is concerned with representing and reasoning about the physical world The goal of qualitative physics is to capture both the commonsense knowledge of the person on the street and the tacit knowledge underlying the quantitative knowledge used by engineers and scientists The succeeding chapter discusses the qualitative calculus and its role in constructing an envisionment that includes behavior over both mythical time and elapsed time These topics are followed by reviews of the mathematical aspects of qualitative reasoning history based simulation and temporal reasoning as well as the intelligence in scientific computing The final chapters are devoted to automated modeling for qualitative reasoning and causal explanations of behavior These chapters also examine the qualitative kinematics of reasoning about shape and space This book will prove useful to psychologists and psychiatrists

**IUTAM Symposium on Interaction between Dynamics and Control in Advanced Mechanical Systems** Dick H. van Campen, 2012-12-06 During the last decades applications of dynamical analysis in advanced often nonlinear engineering systems have been evolved in a revolutionary way In this context one can think of applications in aerospace engineering like satellites in naval engineering like ship motion in mechanical engineering like rotating machinery vehicle systems robots and biomechanics and in civil engineering like earthquake dynamics and offshore technology One could continue with this list for a long time The application of advanced dynamics in the above fields has been possible due to the use of sophisticated computational techniques employing powerful concepts of nonlinear dynamics These concepts have been and are being developed in mathematics mechanics and physics It should be remarked that careful experimental studies are vitally needed to establish the real existence and observability of the predicted dynamical phenomena The interaction between nonlinear dynamics and nonlinear control in advanced engineering systems is becoming of increasing importance because of several reasons Firstly control strategies in nonlinear systems are used to obtain desired dynamic behaviour and improved reliability during operation Applications include power plant rotating machinery vehicle

systems robotics etc Terms like motion control optimal control and adaptive control are used in this field of interest Since mechanical and electronic components are often necessary to realize the desired action in practice the engineers use the term mechatronics to indicate this field If the desired dynamic behaviour is achieved by changing design variables mostly called system parameters one can think of fields like control of chaos

*Gross Motion Planning* Y. K. Hwang, Narendra Ahuja, 1992

**Foundations of Intelligent Systems** Floriana Esposito, Olivier Pivert, Mohand-Said Hacid, Zbigniew W. Rás, Stefano Ferilli, 2015-11-02 This book constitutes the refereed proceedings of the 22nd International Symposium on Methodologies for Intelligent Systems ISMIS 2015 held in Lyon France in October 2015 The 31 revised full papers presented together with 18 short papers were carefully reviewed and selected from 67 submissions The papers are organized in topical sections on data mining methods databases information retrieval recommender systems machine learning knowledge representation semantic web emotion recognition music information retrieval network analysis multi agent systems applications planning classification and textual data analysis and mining

**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 interest in a wide variety of application domains including manufacturing construction waste management space exploration undersea work assistance 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 usefulness are likely to emerge Developing the technologies necessary for autonomous robots is a formidable undertaking with deep interweaved ramifications in automated reasoning perception and control It raises many important problems 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 own motions

**Spatial Representation and Motion Planning** Angel P. del Pobil, Miquel A. Serna, 1995-11-08 This book is devoted to the development of adequate spatial representations for robot motion planning Drawing upon advanced heuristic techniques from AI and computational geometry the authors introduce a general model for spatial representation of physical objects This model is then applied to two key problems in intelligent robotics collision detection and motion planning In addition the application to actual robot arms is kept always in mind instead of dealing with simplified models This monograph is built upon Angel del Pobil's PhD thesis which was selected as the winner of the 1992 Award of the Spanish Royal Academy of Doctors

*Qualitative Place Vocabularies for Mechanisms in Configuration Space*

Boi Faltings,1987      **NASA Tech Briefs** ,1993      **Fundamentals Of Robotics: Linking Perception To Action** Ming Xie,2003-04-11 Tomorrow s robots which includes the humanoid robot can perform task like tutoring children working as tour guides driving humans to and from work do the family shopping etc Tomorrow s robots will enhance lives in ways we never dreamed possible No time to attend the decisive meeting on Asian strategy Let your robot go for you and make the decisions Not feeling well enough to go to the clinic Let Dr Robot come to you make a diagnosis and get you the necessary medicine for treatment No time to coach the soccer team this week Let the robot do it for you Tomorrow s robots will be the most exciting and revolutionary things to happen to the world since the invention of the automobile It will change the way we work play think and live Because of this nowadays robotics is one of the most dynamic fields of scientific research These days robotics is offered in almost every university in the world Most mechanical engineering departments offer a similar course at both the undergraduate and graduate levels And increasingly many computer and electrical engineering departments are also offering it This book will guide you the curious beginner from yesterday to tomorrow The book will cover practical knowledge in understanding developing and using robots as versatile equipment to automate a variety of industrial processes or tasks But the book will also discuss the possibilities we can look forward to when we are capable of creating a vision guided learning machine      **Probabilistic Motion Planning for Automated Vehicles** Naumann, Maximilian,2021-02-25 In motion planning for automated vehicles a thorough uncertainty consideration is crucial to facilitate safe and convenient driving behavior This work presents three motion planning approaches which are targeted towards the predominant uncertainties in different scenarios along with an extended safety verification framework The approaches consider uncertainties from imperfect perception occlusions and limited sensor range and also those in the behavior of other traffic participants      *Control of Nonholonomic Systems: from Sub-Riemannian Geometry to Motion Planning* Frédéric Jean,2014-07-17 Nonholonomic systems are control systems which depend linearly on the control Their underlying geometry is the sub Riemannian geometry which plays for these systems the same role as Euclidean geometry does for linear systems In particular the usual notions of approximations at the first order that are essential for control purposes have to be defined in terms of this geometry The aim of these notes is to present these notions of approximation and their application to the motion planning problem for nonholonomic systems      Scale-Space Theory in Computer Vision Tony Lindeberg,2013-03-09 The problem of scale pervades both the natural sciences and the vi sual arts The earliest scientific discussions concentrate on visual per ception much like today and occur in Euclid s c 300 B C Optics and Lucretius c 100 55 B C On the Nature of the Universe A very clear account in the spirit of modern scale space theory is presented by Boscovitz in 1758 with wide ranging applications to mathemat ics physics and geography Early applications occur in the cartographic problem of generalization the central idea being that a map in order to be useful has to be a generalized coarse grained representation of the actual terrain Miller and Voskuil 1964 Broadening the scope asks for progressive summarizing Very much the same problem occurs

in the realistic artistic rendering of scenes Artistic generalization has been analyzed in surprising detail by John Ruskin in his *Modern Painters* who even describes some of the more intricate generic scale spaces in generalities in detail Where the ancients considered only the merging of blobs under blurring Ruskin discusses the case where a blob splits off another one when the resolution is decreased a case that has given rise to confusion even in the modern literature



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