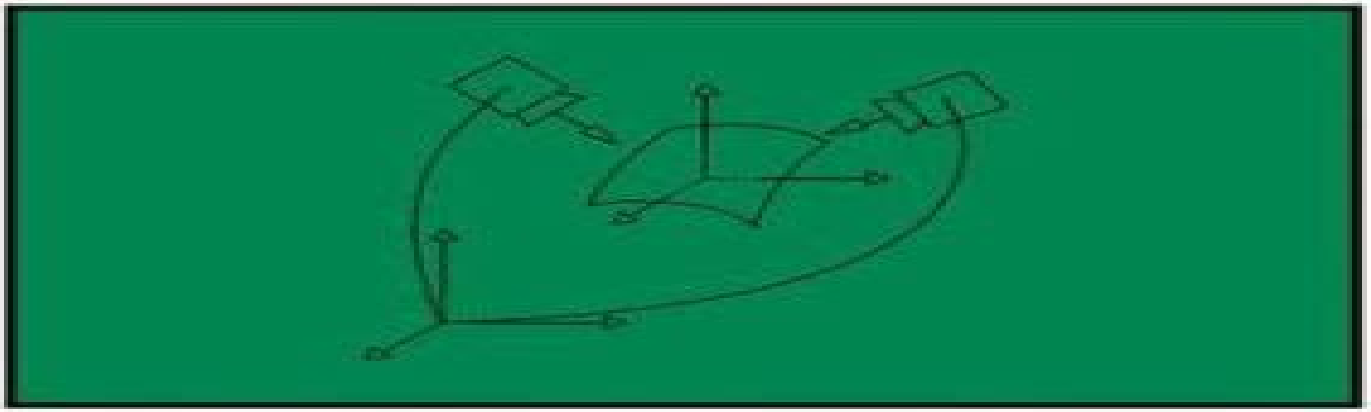
Integration, Coordination and Control of Multi-Sensor Robot Systems

Hugh F. Durrant-Whyte



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Integration Coordination And Control Of Multisensor Robot Systems

Anthony R. Fraser,Ronald Daniel

Integration Coordination And Control Of Multisensor Robot Systems:

Integration, Coordination and Control of Multi-Sensor Robot Systems Hugh F. Durrant-Whyte,2012-12-06 Overview Recent years have seen an increasing interest in the development of multi sensory robot systems The reason for this interest stems from a realization that there are fundamental limitations on the reconstruction of environment descriptions using only a single source of sensor information If robot systems are ever to achieve a degree of intelligence and autonomy they must be capable of using many different sources of sensory information in an active and dynamic manner The observations made by the different sensors of a multi sensor system are always uncertain usually partial occasionally spuri9us or incorrect and often geographically or geometrically imcomparable with other sensor views The sensors of these systems are characterized by the diversity of information that they can provide and by the complexity of their operation It is the goal of a multi sensor system to combine information from all these different sources into a robust and consistent description of the environment **Springer Handbook of Robotics** Bruno Siciliano,Oussama Khatib,2016-07-27 The second edition of this handbook provides a state of the art overview on the various aspects in the rapidly developing field of robotics Reaching for the human frontier robotics is vigorously engaged in the growing challenges of new emerging domains Interacting exploring and working with humans the new generation of robots will increasingly touch people and their lives The credible prospect of practical robots among humans is the result of the scientific endeavour of a half a century of robotic developments that established robotics as a modern scientific discipline The ongoing vibrant expansion and strong growth of the field during the last decade has fueled this second edition of the Springer Handbook of Robotics The first edition of the handbook soon became a landmark in robotics publishing and won the American Association of Publishers PROSE Award for Excellence in Physical Sciences Mathematics as well as the organization s Award for Engineering Technology The second edition of the handbook edited by two internationally renowned scientists with the support of an outstanding team of seven part editors and more than 200 authors continues to be an authoritative reference for robotics researchers newcomers to the field and scholars from related disciplines The contents have been restructured to achieve four main objectives the enlargement of foundational topics for robotics the enlightenment of design of various types of robotic systems the extension of the treatment on robots moving in the environment and the enrichment of advanced robotics applications Further to an extensive update fifteen new chapters have been introduced on emerging topics and a new generation of authors have joined the handbook s team A novel addition to the second edition is a comprehensive collection of multimedia references to more than 700 videos which bring valuable insight into the contents The videos can be viewed directly augmented into the text with a smartphone or tablet using a unique and specially designed app Springer Handbook of Robotics Multimedia Extension Portal http handbookofrobotics org **Self-Organization, Computational Maps, and Motor Control** P.G. Morasso,V. Sanguineti,1997-03-19 In the study of the computational structure of biological robotic sensorimotor systems distributed

models have gained center stage in recent years with a range of issues including self organization non linear dynamics field computing etc This multidisciplinary research area is addressed here by a multidisciplinary team of contributors who provide a balanced set of articulated presentations which include reviews computational models simulation studies psychophysical and neurophysiological experiments The book is divided into three parts each characterized by a slightly different focus in part I the major theme concerns computational maps which typically model cortical areas according to a view of the sensorimotor cortex as geometric engine and the site of internal models of external spaces Part II also addresses problems of self organization and field computing but in a simpler computational architecture which although lacking a specialized cortical machinery can still behave in a very adaptive and surprising way by exploiting the interaction with the real world Finally part III is focused on the motor control issues related to the physical properties of muscular actuators and the dynamic interactions with the world The reader will find different approaches on controversial issues such as the role and nature of force fields the need for internal representations the nature of invariant commands the vexing question about coordinate transformations the distinction between hierachiacal and bi directional modelling and the influence of muscle stiffness *A General Model of Legged Locomotion on Natural Terrain* David J. Manko,2012-12-06 Dynamic modeling is the fundamental building block for mechanism analysis design control and performance evaluation One class of mechanism legged machines have multiple closed chains established through intermittent ground contacts Further walking on natural terrain introduces nonlinear system compliance in the forms of foot sinkage and slippage Closed chains constrain the possible motions of a mechanism while compliances affect the redistribution of forces throughout the system A General Model of Legged Locomotion on Natural Terrain develops a dynamic mechanism model that characterizes indeterminate interactions of a closed chain robot with its environment The approach is applicable to any closed chain mechanism with sufficient contact compliance although legged locomotion on natural terrain is chosen to illustrate the methodology The modeling and solution procedures are general to all walking machine configurations including bipeds quadrupeds beam walkers and hopping machines This work develops a functional model of legged locomotion that incorporates for the first time non conservative foot soil interactions in a nonlinear dynamic formulation The model was applied to a prototype walking machine and simulations generated significant insights into walking machine performance on natural terrain The simulations are original and essential contributions to the design evaluation and control of these complex robot systems While posed in the context of walking machines the approach has wider applicability to rolling locomotors cooperating manipulators multi fingered hands and prehensile agents *Advanced Topics in Artificial Intelligence* Norman Foo,2007-12-07 The 12th Australian Joint Conference on Artificial Intelligence AI QQ held in Sydney Australia 6 10 December 1999 is the latest in a series of annual re gional meetings at which advances in artificial intelligence are reported This series now attracts many international papers and indeed the constitution of the program committee reflects this geographical diversity Besides the

usual tutorials and workshops this year the conference included a companion sympo sium at which papers on industrial appUcations were presented The symposium papers have been published in a separate volume edited by Eric Tsui Ar99 is organized by the University of New South Wales and sponsored by the Aus tralian Computer Society the Commonwealth Scientific and Industrial Research Organisation CSIRO Computer Sciences Corporation the KRRU group at Griffith University the Australian Artificial Intelligence Institute and Neuron Works Ltd Ar99 received over 120 conference paper submissions of which about o third were from outside Australia Prom these 39 were accepted for regular presentation and a further 15 for poster display These proceedings contain the full regular papers and extended summaries of the poster papers All papers were refereed mostly by two or three reviewers selected by members of the program committee and a list of these reviewers appears later The technical program comprised two days of workshops and tutorials fol lowed by three days of conference and symposium plenary and paper sessions **Measurement of Image Velocity** David J. Fleet,2012-12-06 Measurement of Image Velocity presents a computational framework for computing motion information from sequences of images Its specific goal is the measurement of image velocity or optical flow the projection of 3 D object motion onto the 2 D image plane The formulation of the problem emphasizes the geometric and photometric properties of image formation and the occurrence of multiple image velocities caused for example by specular reflections shadows or transparency The method proposed for measuring image velocity is based on the phase behavior in the output of velocity tuned filters Extensive experimental work is used to show that phase can be a reliable source of pure image translation small geometric deformation smooth contrast variations and multiple local velocities Extensive theorectical analysis is used to explain the robustness of phase with respect to deviations from image translation and to detect situations in which phase becomes unstable The results indicate that optical flow may be extracted reliably for computing egomotion and structure from motion The monograph also contains a review of other techniques and frequency analysis applied to image sequences and it discusses the closely related topics of zero crossing tracking gradient based methods and the measurement of binocular disparity The work is relevant to those studying machine vision and visual perception **RoboCup 2004: Robot Soccer World Cup VIII** Daniele Nardi,Martin Riedmiller,Claude Sammut,José Santos-Victor,2005-03-23 ThesearetheproceedingsoftheRoboCup2004Symposium heldattheInstituto Superior T ecnico in Lisbon Portugal in conjunction with the RoboCup c petition The papers presented here document the many innovations in robotics that result from RoboCup A problem in any branch of science or engineering is how to devise tests that can provide objective comparisons between alt native methods In recent years competitive engineering challenges have been established to motivate researchers to tackle di cult problems while providing a framework for the comparison of results RoboCup was one of the rst such competitions and has been a model for the organization of challenges foll ing sound scienti c principles In addition to the competition the associated symposium provides a forum for researchers to present refereed papers But for RoboCup the symposium has the greater goal of encouraging the exchange of

ideas between teams so that the competition as a whole progresses from year to year and strengthens its contribution to robotics One hundred and eighteen papers were submitted to the Symposium Each paper was reviewed by at least two international referees 30 papers were cepted for presentation at the Symposium as full papers and a further 38 were accepted for poster presentation The quality of the Symposium could not be maintained without the support of the authors and the generous assistance of the referees 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 *Adaptive Modelling, Estimation and Fusion from Data* Chris Harris,Xia Hong,Qiang Gan,2012-10-05 In a world of almost permanent and rapidly increasing electronic data availability techniques of filtering compressing and interpreting this data to transform it into valuable and easily comprehensible information is of utmost importance One key topic in this area is the capability to deduce future system behavior from a given data input This book brings together for the first time the complete theory of data based neurofuzzy modelling and the linguistic attributes of fuzzy logic in a single cohesive mathematical framework After introducing the basic theory of data based modelling new concepts including extended additive and multiplicative submodels are developed and their extensions to state estimation and data fusion are derived All these algorithms are illustrated with benchmark and real life examples to demonstrate their efficiency Chris Harris and his group have carried out pioneering work which has tied together the fields of neural networks and linguistic rule based algortihms This book is aimed at researchers and scientists in time series modeling empirical data modeling knowledge discovery data mining and data fusion **Artificial Vision for Mobile Robots** Nicholas Ayache,1991 To give mobile robots real autonomy and to permit them to act efficiently in a diverse cluttered and changing environment they must be equipped with powerful tools for perception and reasoning Artificial Vision for Mobile Robots presents new theoretical and practical tools useful for providing mobile robots with artificial vision in three dimensions including passive binocular and trinocular stereo vision local and global 3D map reconstructions fusion of local 3D maps into a global 3D map 3D navigation control of uncertainty and strategies of perception Numerous examples from research carried out at INRIA with the Esprit Depth and Motion Analysis project are presented in a clear and concise manner Nicolas Ayache is Research Director at INRIA Le Chesnay France Contents General Introduction Stereo Vision Introduction Calibration Image Representation Binocular Stereo Vision Constraints Binocular Stereo Vision Algorithms Experiments in Binocular Stereo

Vision Trinocular Stereo Vision Outlook Multisensory Perception Introduction A Unified Formalism Geometric Representation Construction of Visual Maps Combining Visual Maps Results Matching and Motion Results Matching and Fusion Outlook

Computer Vision - ECCV 2002 Anders Heyden,Gunnar Sparr,Mads Nielsen,Peter Johansen,2003-08-02 Premiering in 1990 in Antibes France the European Conference on Computer Vision ECCV has been held biennially at venues all around Europe These conferences have been very successful making ECCV a major event to the computer vision community ECCV 2002 was the seventh in the series The privilege of organizing it was shared by three universities The IT University of Copenhagen the University of Copenhagen and Lund University with the conference venue in Copenhagen These universities lie geographically close in the vivid Oresund region which lies partly in Denmark and partly in Sweden with the newly built bridge opened summer 2000 crossing the sound that formerly divided the countries We are very happy to report that this year s conference attracted more papers than ever before with around 600 submissions Still together with the conference board we decided to keep the tradition of holding ECCV as a single track conference Each paper was anonymously refereed by three different reviewers For the nal selection for the rst time for ECCV a system with area chairs was used These met with the program chairsinLundfortwodaysinFebruary2002toselectwhatbecame45oralpresentations and 181 posters Also at this meeting the selection was made without knowledge of the authors identity **Variable Gain Design in Stochastic Iterative Learning Control** Dong Shen,2025-01-02 This book investigates the critical gain design in stochastic iterative learning control SILC including four specific gain design strategies decreasing gain design adaptive gain design event triggering gain design and optimal gain design The key concept for the gain design is to balance multiple performance indices such as high tracking precision effective noise reduction and fast convergence speed These gain design techniques can be applied to various control algorithms for stochastic systems to realize a high tracking performance This book provides a series of design and analysis techniques for the establishment of a systematic framework of gain design in SILC The book is intended for scholars and graduate students who are interested in stochastic control recursive algorithms design and iterative learning control **Sensor Modelling, Design and Data Processing for Autonomous Navigation** Martin David Adams,1999 This invaluable book presents an unbiased framework for modelling and using sensors to aid mobile robot navigation It addresses the problem of accurate and reliable sensing in confined environments and makes a detailed analysis of the design and construction of a low cost optical range finder This is followed by a quantitative model for determining the sources and propagation of noise within the sensor The physics behind the causes of erroneous data is also used to derive a model for detecting and labelling such data as false In addition the author s data processing algorithms are applied to the problem of environmental feature extraction This forms the basis of a solution to the problem of mobile robot localisation The book develops a relationship between the kinematics of a mobile robot during the execution of successive manoeuvres and the sensed features Results which update a mobile vehicle s position using features from 2D and 3D scans are presented

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 **Dynamic Analysis of Robot Manipulators** Constantinos A. Balafoutis,Rajnikant V. Patel,2012-12-06 The purpose of this monograph is to present computationally efficient algorithms for solving basic problems in robot manipulator dynamics In par ticular the following problems of rigid link open chain manipulator dynam ics are considered i computation of inverse dynamics ii computation of forward dynamics and iii generation of linearized dynamic models Com putationally efficient solutions of these problems are prerequisites for real time robot applications and simulations Cartesian tensor analysis is the mathematical foundation on which the above mentioned computational algorithms are based In particular it is shown in this monograph that by exploiting the relationships between second order Cartesian tensors and their vector invariants a number of new tensor vector identities can be obtained These identities enrich the theory of Carte sian tensors and allow us to manipulate complex Cartesian tensor equations effuctively Moreover based on these identities the classical vector descrip tion for the Newton Euler equations of rigid body motion are rewritten in an equivalent tensor formulation which is shown to have computational advan tages over the classical vector formulation Thus based on Cartesian tensor analysis a conceptually simple easy to implement and computationally efficient tensor methodology is presented in this monograph for studying classical rigid body dynamics XlI Application of this tensor methodology to the dynamic analysis of rigid link open chain robot manipulators is simple and leads to an efficient fonnulation of the dynamic equations of motion Nonlinear Filtering Jitendra R. Raol,Girija Gopalratnam,Bhekisipho Twala,2017-07-12 Nonlinear Filtering covers linear and nonlinear filtering in a comprehensive manner with appropriate theoretic and practical development Aspects of modeling estimation recursive filtering linear filtering and nonlinear filtering are presented with appropriate and sufficient mathematics A modeling control system

approach is used when applicable and detailed practical applications are presented to elucidate the analysis and filtering concepts MATLAB routines are included and examples from a wide range of engineering applications including aerospace automated manufacturing robotics and advanced control systems are referenced throughout the text **Qualitative Motion Understanding** Wilhelm Burger,Bir Bhanu,2012-12-06 Mobile robots operating in real world outdoor scenarios depend on dynamic scene understanding for detecting and avoiding obstacles recognizing landmarks acquiring models and for detecting and tracking moving objects Motion understanding has been an active research effort for more than a decade searching for solutions to some of these problems however it still remains one of the more difficult and challenging areas of computer vision research Qualitative Motion Understanding describes a qualitative approach to dynamic scene and motion analysis called DRIVE Dynamic Reasoning from Integrated Visual Evidence The DRIVE system addresses the problems of a estimating the robot s egomotion b reconstructing the observed 3 D scene structure and c evaluating the motion of individual objects from a sequence of monocular images The approach is based on the FOE focus of expansion concept but it takes a somewhat unconventional route The DRIVE system uses a qualitative scene model and a fuzzy focus of expansion to estimate robot motion from visual cues to detect and track moving objects and to construct and maintain a global dynamic reference model **Applied Mechanics Reviews** ,1989 Perturbation Techniques for Flexible Manipulators Anthony R. Fraser,Ronald Daniel,1991-06-30 A manipulator or robot consists of a series of bodies links connected by joints to form a spatial mechanism Usually the links are connected serially to form an open chain The joints are either revolute rotary or prismatic telescopic various combinations of the two giving a wide va riety of possible configurations Motive power is provided by pneumatic hydraulic or electrical actuation of the joints The robot arm is distinguished from other active spatial mechanisms by its reprogrammability Therefore the controller is integral to any de scription of the arm In contrast with many other controlled processes e g batch reactors it is possible to model the dynamics of a ma nipulator very accurately Unfortunately for practical arm designs the resulting models are complex and a considerable amount of research ef fort has gone into improving their numerical efficiency with a view to real time solution 32 41 51 61 77 87 91 In recent years improvements in electric motor technology coupled with new designs such as direct drive arms have led to a rapid increase in the speed and load carrying capabilities of manipulators However this has meant that the flexibility of the nominally rigid links has become increasingly significant Present generation manipulators are limited to a load carrying capacity of typically 5 10% of their own weight by the requirement of rigidity For example the Cincinatti Milicron T3R3 robot weighs more than 1800 kg but has a maximum payload capacity of 23 kg **Computer-Aided Mechanical Assembly Planning** Luis S. Homem de Mello,Sukhan Lee,2012-12-06 Some twenty years have elapsed since the first attempts at planning were made by researchers in artificial intelligence These early programs concentrated on the development of plans for the solution of puzzles or toy problems like the rearrangement of stacks of blocks These early programs provided the foundation for the

work described in this book the automatic generation of plans for industrial assembly As one reads about the complex and sophisticated planners in the current gen eration it is important to keep in mind that they are addressing real world problems Although these systems may become the toy systems of tomor row they are providing a solid foundation for future more general and more advanced planning tools As demonstrated by the papers in this book the field of computer aided mechanical assembly planning is maturing It now may include geometric descriptions of parts extracted from or compatible with CAD programs constraints related to part interference and the use of tools fixtures and jigs required for the assembly the nature of connectors matings and other relations between parts number of turnovers required during the assembly handling and gripping requirements for various parts automatic identification of subassemblies This is not an exhaustive list but it serves to illustrate the complexity of some of the issues which are discussed in this book Such issues must be considered in the design of the modern planners as they produce desirable assembly sequences and precedence relations for assembly

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