Autonomous Intelligent Vehicles Theory Algorithms And Implementation Advances In Computer Vision And Pattern Recognition

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Automated Driving Daniel Watzenig 2016-09-23
The main topics of this book include advanced control, cognitive data processing, high performance computing, functional safety, and comprehensive validation. These topics are seen as technological bricks to drive forward automated driving. The current state of the art of automated vehicle research, development and innovation is given. The book also addresses industry-driven roadmaps for major new technology advances as well as collaborative European initiatives supporting the evolvement of automated driving. Various examples highlight the state of development of automated driving as well as the way forward. The book will be of interest to academics and researchers within engineering, graduate students, automotive engineers at OEMs and suppliers, ICT and software engineers, managers, and other decision-makers.

Creating Autonomous Vehicle Systems - Shaoshan Liu 2017-10-25
This book is the first technical overview of autonomous vehicles written for a general computing and engineering audience. The authors share their practical experiences of creating autonomous vehicle systems. These systems are complex, consisting of three major subsystems: (1) algorithms for localization, perception, and planning and control; (2) client systems, such as the robotics operating system and hardware platform; and (3) the cloud platform, which includes data storage, simulation, high-definition (HD) mapping, and deep learning model training. The algorithm subsystem extracts meaningful information from sensor raw data to understand its environment and make decisions about its actions. The client subsystem integrates these algorithms to meet real-time and reliability requirements. The cloud platform provides

offline computing and storage capabilities for autonomous vehicles. Using the cloud platform, we are able to test new algorithms and update the HD map—plus, train better recognition, tracking, and decision models. This book consists of nine chapters. Chapter 1 provides an overview of autonomous vehicle systems; Chapter 2 focuses on localization technologies; Chapter 3 discusses traditional techniques used for perception; Chapter 4 discusses deep learning based techniques for perception; Chapter 5 introduces the planning and control sub-system, especially prediction and routing technologies; Chapter 6 focuses on motion planning and feedback control of the planning and control subsystem; Chapter 7 introduces reinforcement learning-based planning and control; Chapter 8 delves into the details of client systems design; and Chapter 9 provides the details of cloud platforms for autonomous driving. This book should be useful to students, researchers, and practitioners alike. Whether you are an undergraduate or a graduate student interested in autonomous driving, you will find herein a comprehensive overview of the whole autonomous vehicle technology stack. If you are an autonomous driving practitioner, the many practical techniques introduced in this book will be of interest to you. Researchers will also find plenty of references for an effective, deeper exploration of the various technologies.

Principles of Robot Motion - Howie Choset 2005-05-20

A text that makes the mathematical underpinnings of robot motion accessible and relates low-level details of implementation to high-level algorithmic concepts. Robot motion planning has become a major focus of robotics. Research findings can be applied not only to robotics but to planning routes on circuit boards, directing digital actors in computer graphics, robot-assisted surgery and medicine, and in novel areas such as drug design and protein folding. This text reflects the great advances that have taken place in the last ten years, including sensor-based planning, probabalistic planning, localization and mapping, and motion planning for dynamic and nonholonomic systems. Its presentation makes the mathematical underpinnings of robot motion accessible to students of computer science and engineering, rleating low-level implementation details to high-level algorithmic concepts.

Beyond the Numbers - Gary J Naples 2000-02-25

In this follow-up to his earlier SAE book By the Numbers: Principles of Automotive Parts Management, Naples focuses on managing the three most important assets of an automobile parts business: financial, customer, and personnel. The book also includes information critical for creating and managing a total quality organization. Beyond the Numbers offers reference material applicable to the parts supply industry and beyond, and provides a framework that parts managers and parts store owners can use to improve overall organizational performance. Naples provides specific and practical guidelines for quality management which will lead to loyal employees, loyal customers, and a better bottom line.

Advanced Microsystems for Automotive Applications 2018 - Jörg Dubbert 2018-08-17

This volume of the Lecture Notes in Mobility series contains papers written by speakers at the 22nd International Forum on Advanced Microsystems for Automotive Applications (AMAA 2018) "Smart Systems for Clean, Safe and Shared Road Vehicles" that was held in Berlin, Germany in September 2018. The authors report about recent breakthroughs in electric and electronic components and systems, driver assistance, vehicle automation and electrification as well as data, clouds and machine learning. Furthermore, innovation aspects and impacts of connected and automated driving are covered. The target audience primarily comprises research experts and practitioners in industry and academia, but the book may also be beneficial for graduate students alike.

Fundamentals of Mechanics of Robotic Manipulation - Marco Ceccarelli 2022

The book explores the fundamental issues of robot mechanics for both the analysis and design of manipulations, manipulators and grippers, taking into account a central role of mechanics and mechanical structures in the development and use of robotic systems with mechatronic design. It examines manipulations that can be performed by robotic manipulators. The contents of the book are kept at a fairly

practical level with the aim to teach how to model, simulate, and operate robotic mechanical systems. The chapters have been written and organized in a way that they can be red even separately, so that they can be used separately for different courses and purposes. The introduction illustrates motivations and historical developments of robotic mechanical systems. Chapter 2 describes the analysis and design of manipulations by automatic machinery and robots; chapter 3 deals with the mechanics of serial-chain manipulators with the aim to propose algorithms for analysis, simulation, and design purposes; chapter 4 introduces the mechanics of parallel manipulators; chapter 5 addresses the attention to mechanical grippers and related mechanics of grasping.

On-Road Intelligent Vehicles - Rahul Kala 2016-04-27

On-Road Intelligent Vehicles: Motion Planning for Intelligent Transportation Systems deals with the technology of autonomous vehicles, with a special focus on the navigation and planning aspects, presenting the information in three parts. Part One deals with the use of different sensors to perceive the environment, thereafter mapping the multi-domain senses to make a map of the operational scenario, including topics such as proximity sensors which give distances to obstacles, vision cameras, and computer vision techniques that may be used to pre-process the image, extract relevant features, and use classification techniques like neural networks and support vector machines for the identification of roads, lanes, vehicles, obstacles, traffic lights, signs, and pedestrians. With a detailed insight into the technology behind the vehicle, Part Two of the book focuses on the problem of motion planning. Numerous planning techniques are discussed and adapted to work for multi-vehicle traffic scenarios, including the use of sampling based approaches comprised of Genetic Algorithm and Rapidly-exploring Random Trees and Graph search based approaches, including a hierarchical decomposition of the algorithm and heuristic selection of nodes for limited exploration, Reactive Planning based approaches, including Fuzzy based planning, Potential Field based planning, and Elastic Strip and logic based planning. Part Three of the book covers the macroscopic concepts related to Intelligent Transportation Systems with a discussion of various topics and concepts related to transportation systems, including a description of traffic flow, the basic theory behind transportation systems, and generation of shock waves. Provides an overall coverage of autonomous vehicles and Intelligent Transportation Systems Presents a detailed overview, followed by the challenging problems of navigation and planning Teaches how to compare, contrast, and differentiate navigation algorithms

Autonomous Intelligent Vehicles - Hong Cheng 2011-11-15

This important text/reference presents state-of-the-art research on intelligent vehicles, covering not only topics of object/obstacle detection and recognition, but also aspects of vehicle motion control. With an emphasis on both high-level concepts, and practical detail, the text links theory, algorithms, and issues of hardware and software implementation in intelligent vehicle research. Topics and features: presents a thorough introduction to the development and latest progress in intelligent vehicle research, and proposes a basic framework; provides detection and tracking algorithms for structured and unstructured roads, as well as on-road vehicle detection and tracking algorithms using boosted Gabor features; discusses an approach for multiple sensor-based multiple-object tracking, in addition to an integrated DGPS/IMU positioning approach; examines a vehicle navigation approach using global views; introduces algorithms for lateral and longitudinal vehicle motion control.

Computing Systems for Autonomous Driving - Weisong Shi 2021-11-15

This book on computing systems for autonomous driving takes a comprehensive look at the state-of-the-art computing technologies, including computing frameworks, algorithm deployment optimizations, systems runtime optimizations, dataset and benchmarking, simulators, hardware platforms, and smart infrastructures. The objectives of level 4 and level 5 autonomous driving require colossal improvement in the computing for this cyber-physical system. Beginning with a definition of computing systems for autonomous driving, this book introduces promising research topics and serves as a useful starting point for those interested in starting in the field. In addition to the current landscape,

the authors examine the remaining open challenges to achieve L4/L5 autonomous driving. Computing Systems for Autonomous Driving provides a good introduction for researchers and prospective practitioners in the field. The book can also serve as a useful reference for university courses on autonomous vehicle technologies.This book on computing systems for autonomous driving takes a comprehensive look at the state-of-the-art computing technologies, including computing frameworks, algorithm deployment optimizations, systems runtime optimizations, dataset and benchmarking, simulators, hardware platforms, and smart infrastructures. The objectives of level 4 and level 5 autonomous driving require colossal improvement in the computing for this cyber-physical system. Beginning with a definition of computing systems for autonomous driving, this book introduces promising research topics and serves as a useful starting point for those interested in starting in the field. In addition to the current landscape, the authors examine the remaining open challenges to achieve L4/L5 autonomous driving. Computing Systems for Autonomous Driving provides a good introduction for researchers and prospective practitioners in the field. The book can also serve as a useful reference for university courses on autonomous vehicle technologies.

Intelligent Vehicles - David Fernández-Llorca 2020-11-24

This book presents the results of the successful Sensors Special Issue on Intelligent Vehicles that received submissions between March 2019 and May 2020. The Guest Editors of this Special Issue are Dr. David Fernández-Llorca, Dr. Ignacio Parra-Alonso, Dr. Iván García-Daza and Dr. Noelia Parra-Alonso, all from the Computer Engineering Department at the University of Alcalá (Madrid, Spain). A total of 32 manuscripts were finally accepted between 2019 and 2020, presented by top researchers from all over the world. The reader will find a well-representative set of current research and developments related to sensors and sensing for intelligent vehicles. The topics of the published manuscripts can be grouped into seven main categories: (1) assistance systems and automatic vehicle operation, (2) vehicle positioning and localization, (3) fault diagnosis and fail-x systems, (4) perception and scene understanding, (5) smart regenerative braking systems for electric vehicles, (6) driver behavior modeling and (7) intelligent sensing. We, the Guest Editors, hope that the readers will find this book to contain interesting papers for their research, papers that they will enjoy reading as much as we have enjoyed organizing this Special Issue

Intelligent Interactive Multimedia Systems and Services 2016 - Giuseppe De Pietro 2016-06-03

This book contains the contributions presented at the ninth international KES conference on Intelligent Interactive Multimedia: Systems and Services, which took place in Puerto de la Cruz, Tenerife, Spain, June 15-17, 2016. It contains 65 peer-reviewed book chapters that focus on issues ranging from intelligent image or video storage, retrieval, transmission and analysis to knowledge-based technologies, from advanced information technology architectures for video processing and transmission to advanced functionalities of information and knowledge-based services. We believe that this book will serve as a useful source of knowledge for both academia and industry, for all those faculty members, research scientists, scholars, Ph.D. students and practitioners, who are interested in fundamental and applied facets of intelligent interactive multimedia.

Automotive Innovation - Patrick Hossay 2019-07-12

Automotive Innovation: The Science and Engineering behind Cutting-Edge Automotive Technology provides a survey of innovative automotive technologies in the auto industry. Automobiles are rapidly changing, and this text explores these trends. IC engines, transmissions, and chassis are being improved, and there are advances in digital control, manufacturing, and materials. New vehicles demonstrate improved performance, safety and efficiency factors; electric vehicles represent a green energy alternative, while sensor technologies and computer processors redefine the nature of driving. The text explores these changes, the engineering and science behind them, and directions for the future.

Multi-Agent Safety - Juan Pimentel 2019-03-07

Safety has been ranked as the number one concern for the acceptance

and adoption of automated vehicles since safety has driven some of the most complex requirements in the development of self-driving vehicles. Recent fatal accidents involving self-driving vehicles have uncovered issues in the way some automated vehicle companies approach the design, testing, verification, and validation of their products. Traditionally, automotive safety follows functional safety concepts as detailed in the standard ISO 26262. However, automated driving safety goes beyond this standard and includes other safety concepts such as safety of the intended functionality (SOTIF) and multi-agent safety. Multi-Agent Safety addresses the concept of safety for self-driving vehicles through the inclusion of 10 recent and highly relevent SAE technical papers. Topics that these papers feature include vehicle interaction with other vehicles, pedestrians, bicyclists, and other road objects. As the second title in a series on automated vehicle safety, each will contain introductory content by the Editor with 10 SAE technical papers specifically chosen to illuminate the specific safety topic of that book.

The Complexity of Robot Motion Planning - John Canny 1988

The Complexity of Robot Motion Planning makes original contributions both to roboticsand to the analysis of algorithms. In this groundbreaking monograph John Canny resolveslong-standing problems concerning the complexity of motion planning and, for the central problem offinding a collision free path for a jointed robot in the presence of obstacles, obtains exponentialspeedups over existing algorithms by applying high-powered new mathematical techniques.Canny's newalgorithm for this "generalized movers' problem," the most-studied and basic robot motion planningproblem, has a single exponential running time, and is polynomial for any given robot. The algorithmhas an optimal running time exponent and is based on the notion of roadmaps - one-dimensionalsubsets of the robot's configuration space. In deriving the single exponential bound, Cannyintroduces and reveals the power of two tools that have not been previously used in geometricalgorithms: the generalized (multivariable) resultant for a system of polynomials and Whitney'snotion of stratified sets. He has also developed a novel representation of object orientation basedon unnormalized quaternions which reduces the complexity of the algorithms and enhances theirpractical applicability.After dealing with the movers' problem, the book next attacks and derivesseveral lower bounds on extensions of the problem: finding the shortest path among polyhedralobstacles, planning with velocity limits, and compliant motion planning with uncertainty. Itintroduces a clever technique, "path encoding," that allows a proof of NP-hardness for the first twoproblems and then shows that the general form of compliant motion planning, a problem that is thefocus of a great deal of recent work in robotics, is non-deterministic exponential time hard. Cannyproves this result using a highly original construction.John Canny received his doctorate from MITAnd 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 DoctoralDissertation Award.

Autonomous Intelligent Vehicles - Hong Cheng 2014-01-25

This important text/reference presents state-of-the-art research on intelligent vehicles, covering not only topics of object/obstacle detection and recognition, but also aspects of vehicle motion control. With an emphasis on both high-level concepts, and practical detail, the text links theory, algorithms, and issues of hardware and software implementation in intelligent vehicle research. Topics and features: presents a thorough introduction to the development and latest progress in intelligent vehicle research, and proposes a basic framework; provides detection and tracking algorithms for structured and unstructured roads, as well as on-road vehicle detection and tracking algorithms using boosted Gabor features; discusses an approach for multiple sensor-based multiple-object tracking, in addition to an integrated DGPS/IMU positioning approach; examines a vehicle navigation approach using global views; introduces algorithms for lateral and longitudinal vehicle motion control.

Towards Dependable Robotic Perception - Anna V. Petrovskaya 2011

Reliable perception is required in order for robots to operate safely in unpredictable and complex human environments. However, reliability of perceptual inference algorithms has been poorly studied so far. These

algorithms capture uncertain knowledge about the world in the form of probabilistic belief distributions. A number of Monte Carlo and deterministic approaches have been developed, but their efficiency depends on the degree of smoothness of the beliefs. In the real world, the smoothness assumption often fails, leading to unreliable perceptual inference results. Motivated by concrete robotics problems, we propose two novel perceptual inference algorithms that explicitly consider local non-smoothness of beliefs and adapt to it. Both of these algorithms fall into the category of iterative divide-and-conquer methods and hence scale logarithmically with desired accuracy. The first algorithm is termed Scaling Series. It is an iterative Monte Carlo technique coupled with annealing. Local non-smoothness is accounted for by sampling strategy and by annealing schedule. The second algorithm is termed GRAB, which stands for Guaranteed Recursive Adaptive Bounding. GRAB is an iterative adaptive grid algorithm, which relies on bounds. In this case, local non-smoothness is captured in terms of local bounds and grid resolution. Scaling Series works well for beliefs with sharp transitions, but without many discontinuities. GRAB is most appropriate for beliefs with many discontinuities. Both of these algorithms far outperform the prior art in terms of reliability, efficiency, and accuracy. GRAB is also able to guarantee that a quality approximation of the belief is produced. The proposed algorithms are evaluated on a diverse set of real robotics problems: tactile perception, autonomous driving, and mobile manipulation. In tactile perception, we localize objects in 3D starting with very high initial uncertainty and estimating all 6 degrees of freedom. The localization is performed based on tactile sensory data. Using Scaling Series, we obtain highly accurate and reliable results in under 1 second. Improved tactile object localization contributes to manufacturing applications, where tactile perception is widely used for workpiece localization. It also enables robotic applications in situations where vision can be obstructed, such as rescue robotics and underwater robotics. In autonomous driving, we detect and track vehicles in the vicinity of the robot based on 2D and 3D laser range finders. In addition to estimating position and velocity of vehicles, we also model and estimate their geometric shape. The geometric model leads to highly accurate estimates of pose and velocity for each vehicle. It also greatly simplifies association of data, which are often split up into separate clusters due to occlusion. The proposed Scaling Series algorithm greatly improves reliability and ensures that the problem is solved within tight real time constraints of autonomous driving. In mobile manipulation, we achieve highly accurate robot localization based on commonly used 2D laser range finders using the GRAB algorithm. We show that the high accuracy allows robots to navigate in tight spaces and manipulate objects without having to sense them directly. We demonstrate our approach on the example of simultaneous building navigation, door handle manipulation, and door opening. We also propose hybrid environment models, which combine high resolution polygons for objects of interest with low resolution occupancy grid representations for the rest of the environment. High accuracy indoor localization contributes directly to home/office mobile robotics as well as to future robotics applications in construction, inspection, and maintenance of buildings. Based on the success of the proposed perceptual inference algorithms in the concrete robotics problems, it is our hope that this thesis will serve as a starting point for further development of highly reliable perceptual inference methods.

Autonomous Driving and Advanced Driver-Assistance Systems (ADAS) Lentin Joseph 2021-12-16

Autonomous Driving and Advanced Driver-Assistance Systems (ADAS): Applications, Development, Legal Issues, and Testing outlines the latest research related to autonomous cars and advanced driver-assistance systems, including the development, testing, and verification for real-time situations of sensor fusion, sensor placement, control algorithms, and computer vision. Features: Co-edited by an experienced roboticist and author and an experienced academic Addresses the legal aspect of autonomous driving and ADAS Presents the application of ADAS in autonomous vehicle parking systems With an infinite number of real-time possibilities that need to be addressed, the methods and the examples included in this book are a valuable source of information for academic

and industrial researchers, automotive companies, and suppliers.
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.
Autonomous Ground Vehicles - Umit Ozguner 2011
In the near future, we will witness vehicles with the ability to provide drivers with several advanced safety and performance assistance features. Autonomous technology in ground vehicles will afford us capabilities like intersection collision warning, lane change warning, backup parking, parallel parking aids, and bus precision parking. Providing you with a practical understanding of this technology area, this innovative resource focuses on basic autonomous control and feedback for stopping and steering ground vehicles.Covering sensors, estimation, and sensor fusion to percept the vehicle motion and surrounding objects, this unique book explains the key aspects that makes autonomous vehicle behavior possible. Moreover, you find detailed examples of fusion and Kalman filtering. From maps, path planning, and obstacle avoidance scenarios...to cooperative mobility among autonomous vehicles, vehicle-to-vehicle communication, and vehicle-to-infrastructure communication, this forward-looking book presents the most critical topics in the field today.
Computer Aided Systems Theory - EUROCAST 2007 - Roberto Moreno Díaz 2007-11-16
This book constitutes the thoroughly refereed post-proceedings of the 11th International Conference on Computer Aided Systems Theory, EUROCAST 2007. Coverage in the 144 revised full papers presented includes formal approaches, computation and simulation in modeling biological systems, intelligent information processing, heuristic problem solving, signal processing architectures, robotics and robotic soccer, cybercars and intelligent vehicles and artificial intelligence components.
Real-Time Road Profile Identification and Monitoring - Yechen Qin 2019-01-22
Ever stringent vehicle safety legislation and consumer expectations inspire the improvement of vehicle dynamic performance, which result in a rising number of control strategies for vehicle dynamics that rely on driving conditions. Road profiles, as the primary excitation source of vehicle systems, play a critical role in vehicle dynamics and also in public transportation. Knowledge of precise road conditions can thus be of great assistance for vehicle companies and government departments to develop proper dynamic control algorithms, and to fix roads in a timely manner and at the minimum cost, respectively. As a result, developing easy-to-use and accurate road estimation methods are of great importance in terms of reducing the cost related to vehicles and road maintenance as well as improving passenger comfort and handling capacity. A few books have already been published on road profile modeling and the influence of road unevenness on vehicle response. However, there is still room to discuss road assessment methods based on vehicle response and how road conditions can be used to improve vehicle dynamics. In this book, we use several generalized vehicle models to demonstrate the concepts, methods, and applications of vehicle response-based road estimation algorithms. In addition, necessary tools, algorithms, and methods are illustrated, and the benefits of the road estimation algorithms are evaluated. Furthermore, several case studies of controllable suspension systems to improve vehicle vertical dynamics are presented.
Characterizing the Safety of Automated Vehicles - Juan Pimentel 2019-03-07
Safety has been ranked as the number one concern for the acceptance and adoption of automated vehicles since safety has driven some of the most complex requirements in the development of self-driving vehicles. Recent fatal accidents involving self-driving vehicles have uncovered issues in the way some automated vehicle companies approach the

design, testing, verification, and validation of their products. Traditionally, automotive safety follows functional safety concepts as detailed in the standard ISO 26262. However, automated driving safety goes beyond this standard and includes other safety concepts such as safety of the intended functionality (SOTIF) and multi-agent safety. Characterizing the Safety of Automated Vehicles addresses the concept of safety for self-driving vehicles through the inclusion of 10 recent and highly relevent SAE technical papers. Topics that these papers feature include functional safety, SOTIF, and multi-agent safety. As the first title in a series on automated vehicle safety, each will contain introductory content by the Editor with 10 SAE technical papers specifically chosen to illuminate the specific safety topic of that book.

Intelligent Vehicle Technologies - Ljubo Vlacic 2001

An exploration of the growing field of intelligent technologies, from intelligent control systems to intelligent sensors. Systems such as in-car navigation devices and cruise control are already being introduced into modern vehicles, but manufacturers are now racing to develop systems such as smart cruise control, on-vehicle driver information systems, collision avoidance systems, vision enhancement and roadworthiness diagnostics systems. There are practical examples and illustrations throughout the book.

Nonlinear Approaches in Engineering Application - Liming Dai 2022

Nonlinear Approaches in Engineering Applications: Design Engineering Problems examines the latest applications of nonlinear approaches in engineering and addresses a range of scientific problems. Chapters are authored by world-class scientists and researchers and focus on the application of nonlinear approaches in different disciplines of engineering and scientific applications, with a strong emphasis on application, physical meaning, and methodologies of the approaches. Topics covered are of high interest in engineering and physics, and an attempt has been made to expose engineers and researchers to a broad range of practical topics and approaches. This book is appropriate for researchers, students, and practicing engineers who are interested in the applications of engineering, physics, and mathematics in nonlinear approaches to solving engineering and science problems. Presents a broad range of practical topics and approaches; Explains approaches to better, safer, and cheaper systems; Emphasizes applications, physical meaning, and methodologies. .

Sparse Representation, Modeling and Learning in Visual Recognition Hong Cheng 2016-10-09

This unique text/reference presents a comprehensive review of the state of the art in sparse representations, modeling and learning. The book examines both the theoretical foundations and details of algorithm implementation, highlighting the practical application of compressed sensing research in visual recognition and computer vision. Topics and features: describes sparse recovery approaches, robust and efficient sparse representation, and large-scale visual recognition; covers feature representation and learning, sparsity induced similarity, and sparse representation and learning-based classifiers; discusses low-rank matrix approximation, graphical models in compressed sensing, collaborative representation-based classification, and high-dimensional nonlinear learning; includes appendices outlining additional computer programming resources, and explaining the essential mathematics required to understand the book.

Safety of the Intended Functionality - Juan Pimentel 2019-03-07

Safety has been ranked as the number one concern for the acceptance and adoption of automated vehicles since safety has driven some of the most complex requirements in the development of self-driving vehicles. Recent fatal accidents involving self-driving vehicles have uncovered issues in the way some automated vehicle companies approach the design, testing, verification, and validation of their products. Traditionally, automotive safety follows functional safety concepts as detailed in the standard ISO 26262. However, automated driving safety goes beyond this standard and includes other safety concepts such as safety of the intended functionality (SOTIF) and multi-agent safety. Safety of the Intended Functionality (SOTIF) addresses the concept of safety for self-driving vehicles through the inclusion of 10 recent and highly relevent SAE technical papers. Topics that these papers feature

include the system engineering management approach and redundancy technical approach to safety. As the third title in a series on automated vehicle safety, this contains introductory content by the Editor with 10 SAE technical papers specifically chosen to illuminate the specific safety topic of that book.

Intelligent Mobile Robot Navigation - Federico Cuesta 2005-03-11

Intelligent Mobile Robot Navigation builds upon the application of fuzzy logic to the area of intelligent control of mobile robots. Reactive, planned, and teleoperated techniques are considered, leading to the development of novel fuzzy control systems for perception and navigation of nonholonomic autonomous vehicles. The unique feature of this monograph lies in its comprehensive treatment of the problem, from the theoretical development of the various schemes down to the real-time implementation of algorithms on mobile robot prototypes. As such, the book spans different domains ranging from mobile robots to intelligent transportation systems, from automatic control to artificial intelligence.

Autonomous Vehicle - Andrzej Zak 2016-09-07

Autonomous vehicles, despite their relatively short history, have already found practical application in many areas of human activity. Such vehicles are usually replacing people in performing tasks that require long operating time and are held in inaccessible or hazardous environments. Nevertheless, autonomous robotics is probably the area that is being developed the most because of the great demand for such devices in different areas of our lives. This book is a collection of experiences shared by scientists from different parts of the world doing researches and daily exploiting autonomous systems. Giving this book in the hands of the reader, we hope that it will be a treasure trove of knowledge and inspiration for further research in the field of autonomous vehicles.

Smart Autonomous Aircraft - Yasmina Bestaoui Sebbane 2015-11-18

With the extraordinary growth of Unmanned Aerial Vehicles (UAV) in research, military, and commercial contexts, there has been a need for a reference that provides a comprehensive look at the latest research in the area. Filling this void, Smart Autonomous Aircraft: Flight Control and Planning for UAV introduces the advanced methods of flight control, planning, situation awareness, and decision making. This book is among the first to emphasize the theoretic and algorithmic side of control and planning in dynamic and uncertain environments. Focused on the latest theory that informs flight planning and control, it describes the use of computational intelligence modeling, control, and planning. Providing background information on fixed-wing unmanned aerial vehicles, the book proceeds from the basics to advanced methods, from classical to the most innovative. It examines the current state of the art and covers the topics required to assess the autonomy of UAVs. An ideal resource for researchers and practitioners working on solutions for implementing advanced capabilities in UAVs, the book details the mathematical underpinnings of each concept and includes illustrative case studies to reinforce understanding. Providing an interdisciplinary point of view on autonomous aircraft, the book reviews the different methodologies of control and planning used to create smart autonomous aircraft. The topics covered in this book have been derived from the author’s research and teaching duties in smart aerospace and autonomous systems and from literature survey. Assuming an understanding of engineering at the undergraduate level, this book is suitable for advanced-level graduate students and PhD students enrolled in UAV or aerial robotics courses.

Autonomous Vehicle Technology - James M. Anderson 2014-01-10

The automotive industry appears close to substantial change engendered by “self-driving” technologies. This technology offers the possibility of significant benefits to social welfare—saving lives; reducing crashes, congestion, fuel consumption, and pollution; increasing mobility for the disabled; and ultimately improving land use. This report is intended as a guide for state and federal policymakers on the many issues that this technology raises.

Advances in Intelligent Vehicles - Yaobin Chen 2014-03-20

Advances in Intelligent Vehicles presents recent advances in intelligent vehicle technologies that enhance the safety, reliability, and performance of vehicles and vehicular networks and systems. This book provides readers with up-to-date research results and cutting-edge technologies in

the area of intelligent vehicles and transportation systems. Topics covered include virtual and staged testing scenarios, collision avoidance, human factors, and modeling techniques. The Series in Intelligent Systems publishes titles that cover state-of-the-art knowledge and the latest advances in research and development in intelligent systems. Its scope includes theoretical studies, design methods, and real-world implementations and applications. Provides researchers and engineers with up-to-date research results and state-of-the art technologies in the area of intelligent vehicles and transportation systems Covers hot topics, including driver assistance systems; cooperative vehicle-highway systems; collision avoidance; pedestrian protection; image, radar and lidar signal processing; and V2V and V2I communications

Autonomous Road Vehicle Path Planning and Tracking Control - Levent Guvenc 2021-12-06

Discover the latest research in path planning and robust path tracking control In Autonomous Road Vehicle Path Planning and Tracking Control, a team of distinguished researchers delivers a practical and insightful exploration of how to design robust path tracking control. The authors include easy to understand concepts that are immediately applicable to the work of practicing control engineers and graduate students working in autonomous driving applications. Controller parameters are presented graphically, and regions of guaranteed performance are simple to visualize and understand. The book discusses the limits of performance, as well as hardware-in-the-loop simulation and experimental results that are implementable in real-time. Concepts of collision and avoidance are explained within the same framework and a strong focus on the robustness of the introduced tracking controllers is maintained throughout. In addition to a continuous treatment of complex planning and control in one relevant application, the Autonomous Road Vehicle Path Planning and Tracking Control includes: A thorough introduction to path planning and robust path tracking control for autonomous road vehicles, as well as a literature review with key papers and recent developments in the area Comprehensive explorations of vehicle, path, and path tracking models, model-in-the-loop simulation models, and hardware-in-the-loop models Practical discussions of path generation and path modeling available in current literature In-depth examinations of collision free path planning and collision avoidance Perfect for advanced undergraduate and graduate students with an interest in autonomous vehicles, Autonomous Road Vehicle Path Planning and Tracking Control is also an indispensable reference for practicing engineers working in autonomous driving technologies and the mobility groups and sections of automotive OEMs.

Smart Charging and Anti-Idling Systems - Yanjun Huang 2018-06-04

As public attention on energy conservation and emission reduction has increased in recent years, engine idling has become a growing concern due to its low efficiency and high emissions. Service vehicles equipped with auxiliary systems, such as refrigeration, air conditioning, PCs, and electronics, usually have to idle to power them. The number of service vehicles (e.g. public-school-tour buses, delivery-refrigerator trucks, police cars, ambulances, armed vehicles, firefighter vehicles) is increasing significantly with tremendous social development. Therefore, introducing new anti-idling solutions is inevitably vital for controlling energy unsustainability and poor air quality. There are a few books about the idling disadvantages and anti-idling solutions. Most of them are more concerned with different anti-idling technologies and their effects on the society rather than elaborating an anti-idling system design considering different applications and limitations. There is still much room to improve existing anti-idling technologies and products. In this book, we took a service vehicle, refrigerator truck, as an example to demonstrate the whole process of designing, optimizing, controlling, and developing a smart charging system for the anti-idling purpose. The proposed system cannot only electrify the auxiliary systems to achieve anti-idling, but also utilize the concepts of regenerative braking and optimal charging strategy to arrive at an optimum solution. Necessary tools, algorithms, and methods are illustrated and the benefits of the optimal anti-idling solution are evaluated.

Handbook of Research of Internet of Things and Cyber-Physical Systems - Amit Kumar Tyagi 2022-06-09

This new volume discusses how integrating IoT devices and cyber-physical systems can help society by providing multiple efficient and affordable services to users. It covers the various applications of IoT-based cyber-physical systems, such as satellite imaging in relation to climate change, industrial control systems, e-healthcare applications, security uses, automotive and traffic monitoring and control, urban smart city planning, and more. The authors also outline the methods, tools, and algorithms for IoT-based cyber-physical systems and explore the integration of machine learning, blockchain, and Internet of Things-based cloud applications. With the continuous emerging new technologies and trends in IoT technology and CPS, this volume will be a helpful resource for scientists, researchers, industry professionals, faculty and students, and others who wish to keep abreast of new developments and new challenges for sustainable development in Industry 4.0.

Path Planning and Tracking for Vehicle Collision Avoidance in Lateral and Longitudinal Motion Directions - Jie Ji 2020-10-09

In recent years, the control of Connected and Automated Vehicles (CAVs) has attracted strong attention for various automotive applications. One of the important features demanded of CAVs is collision avoidance, whether it is a stationary or a moving obstacle. Due to complex traffic conditions and various vehicle dynamics, the collision avoidance system should ensure that the vehicle can avoid collision with other vehicles or obstacles in longitudinal and lateral directions simultaneously. The longitudinal collision avoidance controller can avoid or mitigate vehicle collision accidents effectively via Forward Collision Warning (FCW), Brake Assist System (BAS), and Autonomous Emergency Braking (AEB), which has been commercially applied in many new vehicles launched by automobile enterprises. But in lateral motion direction, it is necessary to determine a flexible collision avoidance path in real time in case of detecting any obstacle. Then, a path-tracking algorithm is designed to assure that the vehicle will follow the predetermined path precisely, while guaranteeing certain comfort and vehicle stability over a wide range of velocities. In recent years, the rapid development of sensor, control, and communication technology has brought both possibilities and challenges to the improvement of vehicle collision avoidance capability, so collision avoidance system still needs to be further studied based on the emerging technologies. In this book, we provide a comprehensive overview of the current collision avoidance strategies for traditional vehicles and CAVs. First, the book introduces some emergency path planning methods that can be applied in global route design and local path generation situations which are the most common scenarios in driving. A comparison is made in the path-planning problem in both timing and performance between the conventional algorithms and emergency methods. In addition, this book introduces and designs an up-to-date path-planning method based on artificial potential field methods for collision avoidance, and verifies the effectiveness of this method in complex road environment. Next, in order to accurately track the predetermined path for collision avoidance, traditional control methods, humanlike control strategies, and intelligent approaches are discussed to solve the path-tracking problem and ensure the vehicle successfully avoids the collisions. In addition, this book designs and applies robust control to solve the path-tracking problem and verify its tracking effect in different scenarios. Finally, this book introduces the basic principles and test methods of AEB system for collision avoidance of a single vehicle. Meanwhile, by taking advantage of data sharing between vehicles based on V2X (vehicle-to-vehicle or vehicle-to-infrastructure) communication, pile-up accidents in longitudinal direction are effectively avoided through cooperative motion control of multiple vehicles.

Autonomous Vehicles - Kasap, Atilla 2022-10-11

Delving deep into the emerging international and federal statutory and legislative developments surrounding Autonomous Vehicle (AV) technologies, Atilla Kasap assesses whether current motor vehicle regulations, liability law and the liability insurance system are fit for purpose today and in the future.

The Role of ISO 26262 - Juan Pimentel 2019-03-07

Safety has been ranked as the number one concern for the acceptance

and adoption of automated vehicles since safety has driven some of the most complex requirements in the development of self-driving vehicles. Recent fatal accidents involving self-driving vehicles have uncovered issues in the way some automated vehicle companies approach the design, testing, verification, and validation of their products. Traditionally, automotive safety follows functional safety concepts as detailed in the standard ISO 26262. However, automated driving safety goes beyond this standard and includes other safety concepts such as safety of the intended functionality (SOTIF) and multi-agent safety. The Role of ISO 26262 addresses the concept of safety for self-driving vehicles through the inclusion of 10 recent and highly relevent SAE technical papers. Topics that these papers feature include model-based systems engineering (MBSE) and the use of SysML language in a management-based approach to safety As the fourth title in a series on automated vehicle safety, this contains introductory content by the Editor with 10 SAE technical papers specifically chosen to illuminate the specific safety topic of that book.

Introduction to Autonomous Mobile Robots, second edition - Roland Siegwart 2011-02-18

The second edition of a comprehensive introduction to all aspects of mobile robotics, from algorithms to mechanisms. Mobile robots range from the Mars Pathfinder mission's teleoperated Sojourner to the cleaning robots in the Paris Metro. This text offers students and other interested readers an introduction to the fundamentals of mobile robotics, spanning the mechanical, motor, sensory, perceptual, and cognitive layers the field comprises. The text focuses on mobility itself, offering an overview of the mechanisms that allow a mobile robot to move through a real world environment to perform its tasks, including locomotion, sensing, localization, and motion planning. It synthesizes material from such fields as kinematics, control theory, signal analysis, computer vision, information theory, artificial intelligence, and probability theory. The book presents the techniques and technology that enable mobility in a series of interacting modules. Each chapter treats a different aspect of mobility, as the book moves from low-level to high-level details. It covers all aspects of mobile robotics, including software and hardware design considerations, related technologies, and algorithmic techniques. This second edition has been revised and updated throughout, with 130 pages of new material on such topics as locomotion, perception, localization, and planning and navigation. Problem sets have been added at the end of each chapter. Bringing together all aspects of mobile robotics into one volume, Introduction to Autonomous Mobile Robots can serve as a textbook or a working tool for beginning practitioners. Curriculum developed by Dr. Robert King, Colorado School of Mines, and Dr. James Conrad, University of North Carolina-Charlotte, to accompany the National Instruments LabVIEW Robotics Starter Kit, are available. Included are 13 (6 by Dr. King and 7 by Dr. Conrad) laboratory exercises for using the LabVIEW Robotics Starter Kit to teach mobile robotics concepts.

Advanced, Contemporary Control - Andrzej Bartoszewicz 2020-06-24

This book presents the proceedings of the 20th Polish Control Conference. A triennial event that was first held in 1958, the conference successfully combines its long tradition with a modern approach to shed light on problems in control engineering, automation, robotics and a wide range of applications in these disciplines. The book presents new theoretical results concerning the steering of dynamical systems, as well as industrial case studies and worked solutions to real-world problems in contemporary engineering. It particularly focuses on the modelling, identification, analysis and design of automation systems; however, it also addresses the evaluation of their performance, efficiency and reliability. Other topics include fault-tolerant control in robotics, automated manufacturing, mechatronics and industrial systems. Moreover, it discusses data processing and transfer issues, covering a variety of methodologies, including model predictive, robust and adaptive techniques, as well as algebraic and geometric methods, and fractional order calculus approaches. The book also examines essential application areas, such as transportation and autonomous intelligent vehicle systems, robotic arms, mobile manipulators, cyber-physical systems, electric drives and both surface and underwater marine vessels.

Lastly, it explores biological and medical applications of the control-theory-inspired methods.

Theories and Practices of Self-Driving Vehicles - Qingguo Zhou 2022-07-03

Self-driving vehicles are a rapidly growing area of research and expertise. Theories and Practice of Self-Driving Vehicles presents a comprehensive introduction to the technology of self driving vehicles across the three domains of perception, planning and control. The title systematically introduces vehicle systems from principles to practice, including basic knowledge of ROS programming, machine and deep learning, as well as basic modules such as environmental perception and sensor fusion. The book introduces advanced control algorithms as well as important areas of new research. This title offers engineers, technicians and students an accessible handbook to the entire stack of technology in a self-driving vehicle. Theories and Practice of Self-Driving Vehicles presents an introduction to self-driving vehicle technology from principles to practice. Ten chapters cover the full stack of driverless technology for a self-driving vehicle. Written by two authors experienced in both industry and research, this book offers an accessible and systematic introduction to self-driving vehicle technology. Provides a comprehensive introduction to the technology stack of a self-driving vehicle Covers the three domains of perception, planning and control Offers foundational theory and best practices Introduces advanced control algorithms and high-potential areas of new research Gives engineers, technicians and students an accessible handbook to self-driving vehicle technology and applications