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Theory of Ground Vehicles **Theory of Ground Vehicles** *Driveline Systems of Ground Vehicles* **Ground Vehicle Dynamics** **Autonomous Ground Vehicles** *Ground Vehicle Dynamics* *Intelligent Unmanned Ground Vehicles* **Autonomous Land Vehicles** **Technology Development for Army Unmanned Ground Vehicles** *Road Vehicle Dynamics* **Model Predictive Control for Yaw Rate Stabilization of Ground Vehicles** **Aerodynamic Study on the Vehicle Shape Parameters with Respect to Ground Simulation Control Applications of Vehicle Dynamics** Exploring Yaw and Roll Dynamics of Ground Vehicles Using TS Fuzzy Approach and a Novel Method for Stability Analysis Based on Lyapunov Exponents Visual Navigation **Numerical Investigation on Unsteady Aerodynamic Stability of Ground Vehicles During the Cornering Entry** **Special Forces Land Vehicles** *Terramechanics and Off-road Vehicles* Advanced Vehicle Dynamics **Road Vehicle Dynamics** **Semi-Active Suspension Control Design for Vehicles** The Use of Microcomputers to Improve Army Ground Vehicle Readiness **Safety Devices for Ground Vehicles; Report of Research Symposium on Simulation and Control of Ground Vehicles and Transportation Systems. Proceedings. AMD-Vol. 80, DSC-Vol. 2** Determining Initial Velocities of Ground Vehicles in

Yaw Using a Generic Algorithm to Optimize Simulation Trajectories *Advances in Unmanned Aerial Vehicles* Advances in Dynamics of Vehicles on Roads and Tracks **The Reference Autonomous Mobility Model Fundamentals of Vehicle Dynamics The Controllability of Ground Vehicles Suffering Random Road Contact Loss Achieving Increased Mobility and Autonomy for Ground Vehicles Over Rough Terrain Introduction to Automotive Engineering** *The Science Behind Batman's Ground Vehicles Robotics Research Energy Storage Requirements & Challenges For Ground Vehicles* **Military - Tanks & Ground Vehicles Autonomous Vehicles in Support of Naval Operations Nonfrictional Power Collection for Guided High-speed Ground Vehicles** Design and Development of Advanced Control Techniques for an Unmanned Ground Vehicle *Multibody Systems Approach to Vehicle Dynamics*

Chenyi Zhang analyzes the influences of moving ground simulation technique in wind tunnel tests. In his work, the classical investigations on vehicle shape parameters with fixed ground conditions are reviewed with modern moving ground simulation technique. The investigations are performed by means of CFD simulations and model scale wind tunnel tests at IFS, University of Stuttgart. The shape parameters of two reference vehicles – the DrivAer and the AeroSUV model with notchback, fastback and estate back – are varied and investigated. The author presents different results in drag and

lift for the varied geometry parameters. The classical results of the parametric study on the vehicle basic shapes for vehicle aerodynamics could be complemented with the findings of the present research. While performance ground vehicles run in a highly dynamic environment, aerodynamic evaluation through wind tunnel tests and the computer simulation analyses are mostly performed under static condition. Study of a coupling relationship between stability of the vehicles and influences of unsteady aerodynamics during the high-speed turns was conducted by the numerical analysis. Two vehicle models were subjected to study under simplified turn motions in the numerical domain by implementing with Eulerian based approach, and the unsteady aerodynamic forces and moments acting on the vehicles were predicted by transient flow solver utilizing Reynolds-Averaged Navier-Stokes equations and compared to the steady cases. A significant correlation between the cornering performance and effects of unsteady aerodynamics on the vehicleâ€TMs stability during the high-speed turns was suggested along with introducing Hypotheses. The unsteady feature of the aerodynamic forces is mainly proposed by altering the CP location due to flow separations and shedded vortices around the bodies. From this research,although no evidence was able to found for relative change in the CP location, the remarkable overshoots and phase lags were identified in the predicted unsteady aerodynamic forces, which were not observed in the steady cases. The external flow fields were examined in order to

determine a correlation between the unsteady aerodynamic forces and the unsteady flow characteristics. Although some indications of the correlation were found near surface of the pressure recovery region around aft of the bodies, negative and low total pressures dominate the external flow field around the bodies due to bluff-body aerodynamics and high Reynolds numbers for the both time-averaged and transient cases.Under those circumstances, determination of the clear correlation has left the researcher huge challenge. This book presents essential knowledge of car vehicle dynamics and control theory with NI LabVIEW software product application, resulting in a practical yet highly technical guide for designing advanced vehicle dynamics and vehicle system controllers. Presenting a clear overview of fundamental vehicle dynamics and vehicle system mathematical models, the book covers linear and non-linear design of model based controls such as wheel slip control, vehicle speed control, path following control, vehicle stability and rollover control, stabilization of vehicle-trailer system. Specific applications to autonomous vehicles are described among the methods. It details the practical applications of Kalman-Bucy filtering and the observer design for sensor signal estimation, alongside lateral vehicle dynamics and vehicle rollover dynamics. The book also discusses high level controllers, alongside a clear explanation of basic control principles for regenerative braking in both electric and hybrid vehicles, and wheel torque vectoring systems. Concrete LabVIEW simulation examples of how the

models and controls are used in representative applications, along with software algorithms and LabVIEW block diagrams are illustrated. It will be of interest to engineering students, automotive engineering students and automotive engineers and researchers. "With this book, Prof. Dr. Vantsevich brings a tremendous contribution to the field of Automotive Transmission and Driveline Engineering, including his innovative methods for optimum driveline synthesis, as well as his experience with the development of various hardware solutions, from the basic limited slip differentials to the most sophisticated mechatronic systems." —Dr.-Ing. Mircea Gradu Director, Transmission and Driveline Engineering Head, Virtual Analysis Tools Chrysler Group LLC Now that vehicles with four and more driving wheels are firmly ensconced in the consumer market, they must provide energy/fuel-saving benefits and improved operational quality including terrain mobility, traction and velocity properties, turnability, and stability of motion. A first-of-its-kind resource, Driveline Systems of Ground Vehicles: Theory and Design presents a comprehensive and analytical treatment of driveline research, design, and tests based on energy efficiency, vehicle dynamics, and operational properties requirements. This volume addresses fundamental engineering problems including how to investigate the effect of different driveline systems on the properties of vehicles and how to determined the optimal characteristics of the driveline system and its power-dividing units (PDUs) and design it for a specific

vehicle to ensure high level of vehicle dynamics, energy efficiency, and performance. The authors develop an analytical apparatus for math modeling of driveline systems that can be compiled from different types of PDUs. They also introduce methodologies for the synthesis of optimal characteristics of PDUs for different types of vehicles. Structured to be useful to engineers of all levels of experience, university professors and graduate students, the book is based on the R&D projects conducted by the authors. It explores intriguing engineering dilemmas such as how to achieve higher energy and fuel efficiency by driving either all the wheels or not all the wheels, solve oversteering issues by managing wheel power distribution, and many other technical problems. This publication covers all the topics which are relevant to Advanced Robotics today, ranging from Systems Design to Reasoning and Planning. It is based on the Seventh International Symposium on Robotics Research held in Germany on October, 21 - 24th, 1995. The papers were written by specialists in the field from the United States, Europe, Japan, Australia and Canada. The editors, who also chaired this symposium, present the latest research results as well as new approaches to long standing problems. Robotics Research is a contribution to the emerging concepts, methods and tools that shape Robotics. The papers range from pure research reports to application-oriented studies. The topics covered include: manipulation, control, virtual reality, motion planning, 3D vision and industrial systems' issues. Road

Vehicle Dynamics: Fundamentals and Modeling with MATLAB®, Second Edition combines coverage of vehicle dynamics concepts with MATLAB v9.4 programming routines and results, along with examples and numerous chapter exercises. Improved and updated, the revised text offers new coverage of active safety systems, rear wheel steering, race car suspension systems, airsprings, four-wheel drive, mechatronics, and other topics. Based on the lead author's extensive lectures, classes, and research activities, this unique text provides readers with insights into the computer-based modeling of automobiles and other ground vehicles. Instructor resources, including problem solutions, are available from the publisher. An assessment of the potential use of on-vehicle microcomputer monitoring of Army ground vehicles. The unique attributes of the microcomputer make possible powerful new techniques for measuring the remaining life of key vehicle components. These techniques include the real-time cumulative measurement of component stress/damage (an innovation called geriometry) and an improvement in trend monitoring through the use of real-time algorithms. Such measures may make it possible to schedule anticipatory maintenance just before the probability of an in-service failure rises to an unacceptable level. This is turn could result in a reduction in the total amount of maintenance and its costs, an improved capability to allocate fixed maintenance resources, and a quantitative measure of vehicle readiness, all of which lead to an improvement in combat and tactical vehicle unit

readiness. Outline of briefing charts: TARDEC and energy storage team mission; Vehicle requirements for energy storage; Army ground vehicle power and energy challenges, Energy storage roadmap, and Technology readiness level assessment. The past decade has seen tremendous interest in the production and refinement of unmanned aerial vehicles, both fixed-wing, such as airplanes and rotary-wing, such as helicopters and vertical takeoff and landing vehicles. This book provides a diversified survey of research and development on small and miniature unmanned aerial vehicles of both fixed and rotary wing designs. From historical background to proposed new applications, this is the most comprehensive reference yet. Comprehensive, up-to-date and firmly rooted in practical experience, a key publication for all automotive engineers, dynamicists and students. An updated edition of the classic reference on the dynamics of road and off-road vehicles As we enter a new millennium, the vehicle industry faces greater challenges than ever before as it strives to meet the increasing demand for safer, environmentally friendlier, more energy efficient, and lower emissions products. Theory of Ground Vehicles, Third Edition gives aspiring and practicing engineers a fundamental understanding of the critical factors affecting the performance, handling, and ride essential to the development and design of ground vehicles that meet these requirements. As in previous editions, this book focuses on applying engineering principles to the analysis of vehicle behavior. A large number of practical

examples and problems are included throughout to help readers bridge the gap between theory and practice. Covering a wide range of topics concerning the dynamics of road and off-road vehicles, this Third Edition is filled with up-to-date information, including: * The Magic Formula for characterizing pneumatic tire behavior from test data for vehicle handling simulations * Computer-aided methods for performance and design evaluation of off-road vehicles, based on the author's own research * Updated data on road vehicle transmissions and operating fuel economy * Fundamentals of road vehicle stability control * Optimization of the performance of four-wheel-drive off-road vehicles and experimental substantiation, based on the author's own investigations * A new theory on skid-steering of tracked vehicles, developed by the author. The automotive industry is one of the largest and most important industries in the world. Cars, buses, and other engine-based vehicles abound in every country on the planet, and it is continually evolving, with electric cars, hybrids, self-driving vehicles, and so on. Technologies that were once thought to be decades away are now on our roads right now. Engineers, technicians, and managers are constantly needed in the industry, and, often, they come from other areas of engineering, such as electrical engineering, process engineering, or chemical engineering. Introductory books like this one are very useful for engineers who are new to the industry and need a tutorial. Also valuable as a textbook for students, this introductory volume not only

covers the basics of automotive engineering, but also the latest trends, such as self-driving vehicles, hybrids, and electric cars. Not only useful as an introduction to the science or a textbook, it can also serve as a valuable reference for technicians and engineers alike. The volume also goes into other subjects, such as maintenance and performance. Data has always been used in every company irrespective of its domain to improve the operational efficiency and performance of engines. This work deals with details of various automotive systems with focus on designing various components of these system to suit the working conditions on roads. Whether a textbook for the student, an introduction to the industry for the newly hired engineer, or a reference for the technician or veteran engineer, this volume is the perfect introduction to the science of automotive engineering. Autonomous vehicles (AVs) have been used in military operations for more than 60 years, with torpedoes, cruise missiles, satellites, and target drones being early examples.1 They have also been widely used in the civilian sector--for example, in the disposal of explosives, for work and measurement in radioactive environments, by various offshore industries for both creating and maintaining undersea facilities, for atmospheric and undersea research, and by industry in automated and robotic manufacturing. Recent military experiences with AVs have consistently demonstrated their value in a wide range of missions, and anticipated developments of AVs hold promise for increasingly significant roles in future naval operations. Advances in AV

capabilities are enabled (and limited) by progress in the technologies of computing and robotics, navigation, communications and networking, power sources and propulsion, and materials. Autonomous Vehicles in Support of Naval Operations is a forward-looking discussion of the naval operational environment and vision for the Navy and Marine Corps and of naval mission needs and potential applications and limitations of AVs. This report considers the potential of AVs for naval operations, operational needs and technology issues, and opportunities for improved operations. Arranged thematically by chapter, Special Forces Land Vehicles provides a complete guide to the jeeps, trucks, armored cars, light AFVs, and motorcycles used by Special Forces units around the world. The book includes: the Desert Patrol Vehicle (DPV) first used during the Gulf War of 1991 by the US Navy SEALs; the ACMAT VT4 cross-country tactical military vehicle deployed by the French Foreign Legion throughout the world; the heavily armed Interim Fast Attack Vehicle (IFAV) beloved of the US Marines' recon units; and the Kawasaki KLR 250-D8 high-performance motorcycle, air-dropped to provide light reconnaissance capabilities for US Rangers in Afghanistan. Illustrated with 100 photographs, Special Forces Land Vehicles is a dynamic guide to both the standard and specialist vehicles deployed by Special Forces soldiers over the last 20 years. Ground Vehicle Dynamics is devoted to the mathematical modelling and dynamical analysis of ground vehicle systems composed of the vehicle body, the

guidance and suspension devices and the corresponding guideway. Automobiles on uneven roads and railways on flexible tracks are prominent representatives of ground vehicle systems. All these different kinds of systems are treated in a common way by means of analytical dynamics and control theory. In addition to a detailed modelling of vehicles as multibody systems, the contact theory for rolling wheels and the modelling of guideways by finite element systems as well as stochastic processes are presented. As a particular result of this integrated approach the state equations of the global systems are obtained including the complete interactions between the subsystems considered as independent modules. The fundamentals of vehicle dynamics for longitudinal, lateral and vertical motions and vibrations of automobiles and railways are discussed in detail. Unmanned ground vehicles (UGV) are expected to play a key role in the Army's Objective Force structure. These UGVs would be used for weapons platforms, logistics carriers, and reconnaissance, surveillance, and target acquisition among other things. To examine aspects of the Army's UGV program, assess technology readiness, and identify key issues in implementing UGV systems, among other questions, the Deputy Assistant Secretary of the Army for Research and Technology asked the National Research Council (NRC) to conduct a study of UGV technologies. This report discusses UGV operational requirements, current development efforts, and technology integration and roadmaps to the future. Key recommendations are presented addressing

technical content, time lines, and milestones for the UGV efforts. Batman rules the streets of Gotham City. But are the high-tech features in his road vehicles real? The answer may surprise you. Look inside to explore how the features in the Batmobile and Batcycle are rooted in real-world science and engineering. Hardbound. The computer-aided methods presented in this book represent recent advances in the methodology for predicting and evaluating off-road vehicle performance. The mathematical models established for vehicle-terrain systems will enable the engineering practitioner to evaluate, on a rational basis, a wide range of options and to select an appropriate vehicle configuration for a given mission and environment. The models take into account all major design and operational parameters, as well as pertinent terrain characteristics.Applications of the computer-aided engineering methods to the parametric analysis of off-road vehicle design are demonstrated through examples. Ground Vehicle Dynamics is devoted to the mathematical modelling and dynamical analysis of ground vehicle systems composed of the vehicle body, the guidance and suspension devices and the corresponding guideway. Automobiles on uneven roads and railways on flexible tracks are prominent representatives of ground vehicle systems. All these different kinds of systems are treated in a common way by means of analytical dynamics and control theory. In addition to a detailed modelling of vehicles as multibody systems, the contact theory for rolling wheels and the modelling of guideways by finite element

systems as well as stochastic processes are presented. As a particular result of this integrated approach the state equations of the global systems are obtained including the complete interactions between the subsystems considered as independent modules. The fundamentals of vehicle dynamics for longitudinal, lateral and vertical motions and vibrations of automobiles and railways are discussed in detail. This book covers the principles and applications of vehicle handling dynamics from an advanced perspective in depth. The methods required to analyze and optimize vehicle handling dynamics are presented, including tire compound dynamics, vehicle planar dynamics, vehicle roll dynamics, full vehicle dynamics, and in-wheel motor vehicle dynamics. The provided vehicle dynamic model is capable of investigating drift, sliding, and other over-limit vehicle maneuvers. This is an ideal book for postgraduate and research students and engineers in mechanical, automotive, transportation, and ground vehicle engineering. 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. Semi-Active Suspension Control Design for Vehicles presents a comprehensive discussion of designing control algorithms for semi-active suspensions. It also covers performance analysis and control design. The book evaluates approaches to different control theories, and it includes methods needed for analyzing and evaluating suspension performances, while identifying optimal performance bounds. The structure of the book follows a classical path of control-system design; it discusses the actuator or the variable-damping shock absorber, models and technologies. It also models and discusses the vehicle that is equipped with semi-active dampers, and the control algorithms. The text can be viewed at three different levels: tutorial for novices and students; application-oriented for engineers and practitioners; and methodology-oriented for researchers. The book is divided into two parts. The first part includes chapters 2 to 6, in which fundamentals of modeling and semi-active control design are discussed. The second part includes chapters 6 to 8, which cover research-oriented

solutions and case studies. The text is a comprehensive reference book for research engineers working on ground vehicle systems; automotive and design engineers working on suspension systems; control engineers; and graduate students in control theory and ground vehicle systems. Appropriate as a tutorial for students in automotive systems, an application-oriented reference for engineers, and a control design-oriented text for researchers that introduces semi-active suspension theory and practice Includes explanations of two innovative semi-active suspension strategies to enhance either comfort or road-holding performance, with complete analyses of both Also features a case study showing complete implementation of all the presented strategies and summary descriptions of classical control algorithms for controlled dampers We summarize some recent results on modeling and control of ground vehicles navigating in high-speed over rough terrain. We start with the modeling of expert race (rally) driving techniques, and we then propose a new graph-search method to bridge the gap between the path-planning and trajectory generation layers in the motion planning control hierarchy. The latter result is of independent theoretical interest, as it can be applied to any graph search problem when transitions between the nodes of the graph depend on the prior history of the path. In striving for optimal comfort and safety conditions in road vehicles, today’s electronically controlled components provide a range of new options. These are developed and tested using computer simulations in software in the loop or

hardware in the loop environments—an advancement that requires the modern automotive engineer to be able to build basic simulation models, handle higher level models, and operate simulation tools effectively. Combining the fundamentals of vehicle dynamics with the basics of computer simulated modeling, Road Vehicle Dynamics: Fundamentals and Modeling Aspects draws on lecture notes from undergraduate and graduate courses given by the author, as well as industry seminars and symposiums, to provide practical insight on the subject. Requiring only a first course in dynamics and programming language as a prerequisite, this highly accessible book offers end-of-chapter exercises to reinforce concepts as well as programming examples and results using MATLAB®. The book uses SI-units throughout, and begins with an introduction and overview of units and quantities, terminology and definitions, multibody dynamics, and equations of motion. It then discusses the road, highlighting both deterministic and stochastic road models; tire handling including contact calculation, longitudinal and lateral forces, vertical axis torques, and measurement and modeling techniques; and drive train components and concepts such as transmission, clutch, and power source. Later chapters discuss suspension systems, including a dynamic model of rack-and-pinion steering as well as double-wishbone suspension systems; force elements such as springs, anti-roll bars, and hydro-mounts; and vehicle dynamics in vertical, longitudinal, and lateral directions using a simple model

approach to examine the effects of nonlinear, dynamic, and active force elements. Highlighting useable knowledge, the book concludes with a three-dimensional vehicle model and typical results of standard driving maneuvers. Mobility modeling is a critical step in the ground vehicle acquisition process for military vehicles. Mobility modeling tools, and in particular the NATO Reference Mobility Model (NRMM), have played a critical role in understanding the mission-level capabilities of ground vehicles. This understanding via modeling supports not only developers during early vehicle design but also decision makers in the field previewing the capabilities of ground vehicles in real-world deployments. Due to decades of field testing and operations, mobility modeling for traditional ground vehicles is well-understood; however, mobility modeling tools for evaluating autonomous mobility are sparse. Therefore, this dissertation proposes and derives a Reference Autonomous Mobility Model (RAMM). The RAMM leverages cutting-edge modeling and simulation tools to build a mobility model that serves as the mission-level mobility modeling tool currently lacking in the unmanned ground vehicle (UGV) community, thereby filling the current analysis gap in the autonomous vehicle acquisition cycle. The RAMM is built on (1) a thorough review of theories of verification and validation of simulations, (2) a novel framework for validating simulations of autonomous systems and (3) the mobility modeling framework already established by the NRMM. These building blocks brought to light the

need for new, validated modeling and simulation (M&S) tools capable of simulating, at a high-fidelity, autonomous unmanned ground vehicle operations. This dissertation maps the derivation of the RAMM, starting with a history of verification of simulation models and a literature review of current autonomous mobility modeling methods. In light of these literature reviews, a new framework for V&V of simulations of autonomous systems is proposed, and the requirements for and derivation of the RAMM is presented. This dissertation concludes with an example application of the RAMM for route planning for autonomous UGVs. Once fully developed, the RAMM will serve as an integral part in the design, development, testing and evaluation, and ultimate fielding of autonomous UGVs for military applications. A world-recognized expert in the science of vehicle dynamics, Dr. Thomas Gillespie has created an ideal reference book that has been used by engineers for 30 years, ranging from an introduction to the subject at the university level to a common sight on the desks of engineers throughout the world. As with the original printing, Fundamentals of Vehicle Dynamics, Revised Edition, strives to find a middle ground by balancing the need to provide detailed conceptual explanations of the engineering principles involved in the dynamics of ground vehicles with equations and example problems that clearly and concisely demonstrate how to apply such principles. A study of this book will ensure that the reader comes away with a solid foundation and is prepared to discuss the subject in

detail. Ideal as much for a first course in vehicle dynamics as it is a professional reference, Fundamentals of Vehicle Dynamics, Revised Edition, maintains the tradition of the original by being easy to read and while receiving updates throughout in the form of modernized graphics and improved readability. Inasmuch as the first edition proved to be so popular, the Revised Edition intends to carry on that tradition for a new generation of engineers. First Published in 1996. Routledge is an imprint of Taylor & Francis, an informa company. THEORY OF GROUND VEHICLES A leading and authoritative text for advancing ground vehicle mobility Theory of Ground Vehicles, Fifth Edition presents updated and expanded coverage of the critical factors affecting the performance, handling, and ride essential to the development and design of road and off-road vehicles. Replacing internal combustion engines with zero-emission powerplants in ground vehicles to eliminate greenhouse gas emissions for curbing climate change has received worldwide attention by both the vehicle industry and governmental agencies. To enhance safety, traffic flow, and operating efficiency of road transport, automated driving systems have been under active development. With growing interest in the exploration of the Moon, Mars, and beyond, research in terramechanics for guiding the development of extraterrestrial rovers has been intensified. In this new edition, these and other topics of interest in the field of ground vehicle technology are explored, and technical data are updated. New features of this edition

include: Expanded coverage of the fundamentals of electric drives, hybrid electric drives, and fuel cell technology Introduction to the classification and operating principles of the automated driving system and cooperative driving automation Applications of terramechanics to guiding the development of extraterrestrial rovers Elaboration on the approach to achieving the optimal operating efficiency of all-wheel drive off-road vehicles Introduction to updated ISO Standards for evaluating vehicle ride An updated and comprehensive text and reference for both the educational and professional communities, Theory of Ground Vehicles, Fifth Edition will prove invaluable to aspiring and practicing engineers seeking to solve real-world road and off-road vehicle mobility problems. Recent years have seen considerable progress towards the goal of autonomous and unmanned ground vehicles which became essential for conducting military operations. These autonomous vehicles have the capability to operate and react to their environments without external control. Autonomous multi-wheeled combat vehicles are crucial for military applications which offer numerous leverages on modern battlefields. Applying autonomy features to such vehicles significantly increases its combat capabilities and expands its applications to work-day and night for risky missions compared with traditional manned ground vehicles. However, it is associated with some challenges because of their large dimension, heavy weight, and complex geometry. Therefore, the development of

autonomous combat vehicles has become a cutting-edge research topic in robotics and automotive engineering. This thesis focuses on the control issues related to applying autonomous features for the multi-wheeled combat vehicles due to their significant influence especially when navigating in the presence of obstacles. The primary concern of path planning is to compute collision-free paths. Another equally important issue is to compute a realizable path and, if possible, achieving an optimal path bringing the vehicle to the final position. For these purposes, the developed methodology considers the combination between the optimal control theory using Pontryagin's Minimum Principle (PMP) and Artificial Potential Filed (APF). In addition, a four-axle bicycle model of the actual multi-wheeled combat vehicle considering the vehicle body lateral and yaw dynamics is developed. To generate the vehicle optimal path in real time, an Artificial Neural Network (ANN) model is proposed. The introduced ANN model allows the vehicle to carry out an autonomous navigation in real time with maintaining the path optimality by considering the vehicle parameters in terms of yaw rate, lateral velocity, heading angle and steering angle. Subsequently, a comparative study and performance analysis of the developed optimal path algorithm using PMP with Dynamic Programming (DP) method was carried out in order to guarantee the global optimum solution. Determining the accurate vehicle position offers sufficient capabilities which increase the autonomy and safety features, especially in case

of off-road locomotion. In this regard, a hybrid framework for positioning technique based on the integration of GPS/INS for combat vehicles is developed. The developed algorithm is able to provide an accurate and reliable vehicle positioning information, even if the number of visible satellites is less than four, due to the harsh vehicle operation environments. In this work, a scaled multi-wheeled combat vehicle model was developed using system identification methodology. Different system identification methods are considered and applied to solve and identify this problem. An advanced control system in terms of fuzzy logic, robust, and PID control systems are designed. In addition, the Processor-In-the-Loop co-simulation (PIL) is considered, which permits and achieves a more realistic situation where the developed control algorithms running on a dedicated processor. The performance and effectiveness of the developed controllers are evaluated for vehicle heading angle tracking using different predefined heading angles. Furthermore, a comparative evaluation to assess the feasibility of the developed control algorithms is discussed. Finally, it should be stated that this work offers the first attempt in the open literature to control the scaled multi-wheeled combat vehicle using different advanced control techniques such as, fuzzy logic, [...]?. This book gathers together papers presented at the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, held on August 12 – 16, 2019, at the Lindholmen Conference Centre in Gothenburg, Sweden. It covers cutting-edge issues related to

vehicle systems, including vehicle design, condition monitoring, wheel and rail contact, automated driving systems, suspension and ride analysis, and many more topics. Written by researchers and practitioners, the book offers a timely reference guide to the field of vehicle systems dynamics, and a source of inspiration for future research and collaborations. The economic potential of autonomous mobile robots will increase tremendously during the next years. Service robots such as cleaning machines and inspection or assistance robots will bring us great support in our daily lives. This textbook provides an introduction to the methods of controlling these robotic systems. Starting from mobile robot kinematics, the reader receives a systematic overview of the basic problems as well as methods and algorithms used for solving them. Localisation, object recognition, map building, navigation and control architectures for autonomous vehicles will be discussed in detail. In conclusion, a survey of specific service robot applications is included as well. This book is a very useful introduction to mobile robotics for beginners as well as advanced students and engineers. Intelligent Unmanned Ground Vehicles describes the technology developed and the results obtained by the Carnegie Mellon Robotics Institute in the course of the DARPA Unmanned Ground Vehicle (UGV) project. The goal of this work was to equip off-road vehicles with computer-controlled, unmanned driving capabilities. The book describes contributions in the area of mobility for UGVs including: tools for assembling complex autonomous mobility

systems; on-road and off-road navigation; sensing techniques; and route planning algorithms. In addition to basic mobility technology, the book covers a number of integrated systems demonstrated in the field in realistic scenarios. The approaches presented in this book can be applied to a wide range of mobile robotics applications, from automated passenger cars to planetary exploration, and construction and agricultural machines. Intelligent Unmanned Ground Vehicles shows the progress that was achieved during this program, from brittle specially-built robots operating under highly constrained conditions, to groups of modified commercial vehicles operating in tough environments. One measure of progress is how much of this technology is being used in other applications. For example, much of the work in road-following, architectures and obstacle detection has been the basis for the Automated Highway Systems (AHS) prototypes currently under development. AHS will lead to commercial prototypes within a few years. The cross-country technology is also being used in the development of planetary rovers with a projected launch date within a few years. The architectural tools built under this program have been used in numerous applications, from an automated harvester to an autonomous excavator. The results reported in this work provide tools for further research development leading to practical, reliable and economical mobile robots.

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