

# **2023 IEEE International Automated Vehicle Validation Conference (IAVVC 2023)**

**Austin, Texas, USA  
16-18 October 2023**



**IEEE Catalog Number: CFP23DY9-POD  
ISBN: 979-8-3503-2254-5**

**Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP23DY9-POD
ISBN (Print-On-Demand):	979-8-3503-2254-5
ISBN (Online):	979-8-3503-2253-8

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## TABLE OF CONTENTS

<p>A Novel Instrumental System for Immersive Simulation-Based Driver-in-the-Loop Vehicular Technology Research and Validation.....</p> <p style="padding-left: 2em;"><i>Xingyu Zhou, Zejiang Wang, Adrian Cosio, Heran Shen, Hyunjin Ahn, Yung-Chi Kung, Mikhaela C. Sample, Michael Moore, Andrea Gold, Heidi W. Ross, Kristie Chin, Junmin Wang</i></p>	1
<p>An Optimized Hybrid Transformer-Based Technique for Real-Time Pedestrian Intention Estimation in Autonomous Vehicles .....</p> <p style="padding-left: 2em;"><i>Mohamed Galloul, Mariam Aboehwafa, Yasser Gadallah</i></p>	7
<p>Convolutional Neural Networks for Interpreting Unclustered Radar Data in Automotive Applications.....</p> <p style="padding-left: 2em;"><i>Yung-Chi Kung, Xingyu Zhou, Heran Shen, Jin Ahn, Junmin Wang</i></p>	13
<p>Quantifying the Impact of Automated Vehicles on Traffic .....</p> <p style="padding-left: 2em;"><i>Martin Sigl, Binnert Prins, Christoph Schütz, Sebastian Wagner, Frederik Schulte, Daniel Watzenig</i></p>	19
<p>Model Predictive Control-Based Trajectory Shaper for Safe and Efficient Adaptive Cruise Control .....</p> <p style="padding-left: 2em;"><i>Anye Zhou, Zejiang Wang, Adian Cook</i></p>	26
<p>Process Assurance for Object Detection Through Deep Neural Networks to Accomplish the Autonomous Aerial Refueling Task.....</p> <p style="padding-left: 2em;"><i>Danielle Clement, Sarah Mottino, Donald Costello</i></p>	33
<p>Decentralized V2X Priority Maneuver Coordination: Evaluation in Small Scale Scenarios .....</p> <p style="padding-left: 2em;"><i>Daniel Maksimovski, Christian Facchi</i></p>	39
<p>Phenomenological Range-Reflectivity Limits for Lidar Models and Feature Validation Approach .....</p> <p style="padding-left: 2em;"><i>Relindis Rott</i></p>	47
<p>CiThruS2: Open-Source Virtual Environment for Simulating Real-Time Drone Operations and Piloting .....</p> <p style="padding-left: 2em;"><i>Emilian Galazka, Arttu Leppäaho, Jarno Vanne</i></p>	54
<p>Improved Vehicle Safety Via Nonlinear Estimation of Tire-Road Force Saturation .....</p> <p style="padding-left: 2em;"><i>Manavendra Desai, Azad Ghaffari</i></p>	62
<p>Performance of Graph Database Management Systems as Route Planning Solutions for Different Data and Usage Characteristics .....</p> <p style="padding-left: 2em;"><i>Karin Festl, Patrick Promitzer, Daniel Watzenig, Huilin Yin</i></p>	68
<p>A Novel Concept for Identifying Critical Test Scenarios for the Validation of Automated Driving Functions .....</p> <p style="padding-left: 2em;"><i>Clemens Kurz, Eva-Maria Knoch, Frank Gauterin</i></p>	74
<p>Ensuring Trustworthy Automated Road Vehicles: A Software Integrity Validation Approach.....</p> <p style="padding-left: 2em;"><i>Dominik Püllen, Felix Klement, Alexey Vinel, Stefan Katzenbeisser</i></p>	79
<p>How Uncertainty Affects Test Results for Driving Automation .....</p> <p style="padding-left: 2em;"><i>Felix Reigys, Christian Steinhauser, Andreas Schwarzhaupt, Eric Sax</i></p>	87

Ground Vehicle Generalized Forces and Moment Governor Design Via Noncertainty-Equivalent Adaptive Prescribed Performance Control .....	93
<i>Xingyu Zhou, Heran Shen, Zejiang Wang, Hyunjin Ahn, Yung-Chi Kung, Junmin Wang</i>	
Wheel-Leg Collaborative Control for Wheel-legged Robots Based on MPC with Preview .....	99
<i>Zheng Pan, Boyuan Li, Hui Jing, Zihua Niu, Rongrong Wang</i>	
Operational Design Domain Qualification Framework for Remotely Driven Vehicles in Urban Environment .....	107
<i>Ole Hans, Mariana Avezum, Stanislav Borysov, Hans-Leo Ross, Jürgen Adamy</i>	
Cooperative Automated Emergency Braking for CAVs Under Time-Varying Communication Delays.....	113
<i>Shahriar Hasan, Svetlana Girs, Elisabeth Uhlemann</i>	
Neural Network Framework for Collision Avoidance in Connected Vehicle Environments.....	120
<i>Jean Bezerra, Rawa Adla</i>	
Adaptive Path-Following Control for Ground Vehicles Using a Switching Non-Quadratic Lyapunov Function.....	126
<i>Xingyu Zhou, Zejiang Wang, Junmin Wang</i>	
Introducing L-Shaping for a Streamlined Lidar-Based Perception in Urban Platooning .....	132
<i>Daniel Baumann, David Kraus, Nicole Kechler, Leo Fiedler, Eric Sax, Niranjana Venkatesh</i>	
Residual Risk Management Strategies at System Level Presented for ACC/LKA Behavioural Competencies .....	138
<i>Selim Solmaz, Georg Stettinger, Franz Wotawa</i>	
Impact of Thermal Aging on Winding Insulation Loss-Of-Life Fraction Using $H_\infty$ Algorithm for Integrated Permanent Magnet In-Wheel Motor.....	145
<i>Maliheh Hashemi, Michael Stolz, Daniel Watzenig</i>	
A Novel Tool Set for Simulating and Optimizing Autonomous On-Demand People Mover Systems.....	151
<i>Peter Krebs, Elaheh Gol Hashem, Bernd Wacke</i>	
Short-Range Radar for Use in Vehicle Lateral Guidance and Control .....	157
<i>Richard A. Bishel</i>	
A Reliable 79GHz Band Ultra-Short Range Radar for ADAS/AD Vehicles Using FMCW Technology .....	164
<i>Zie Eya Ekolle, Ryuji Kohno, Hideki Ochiai, Sawada Sadamasa, Ishikawa Ikenji, Ikeda Hiroshi, Ohashi Naomi</i>	
Structured Testing Framework for ADAS Algorithm Development.....	170
<i>Sachin Fernando, Ansar Khan, Roydon Fraser, William Melek</i>	
Reducing Conservativeness of Polytopic Linear-Parameter-Varying Robust Vehicle Sideslip Angle Observer Through Minimum-Area Convex Quadrilateral Design .....	176
<i>Xingyu Zhou, Hyunjin Ahn, Heran Shen, Yung-Chi Kung, Zejiang Wang, Junmin Wang</i>	

Transnational Testing, Operation and Certification of Automated Driving Systems: Perspective from testEPS and Central System EUREKA Projects - Mid-Term Results.....	182
<i>Jakob Reckenzaun, Relindis Rott, Martin Kirchengast, David J. Ritter, Pamela Innerwinkler, Selim Solmaz, Christoph Pilz, Markus Schratter, Arno Eichberger, Tomislav Mihalj, Leander B. Hörmann, Albert Pötsch, Patrick Luley, Stefan Ladstätter, Thomas Strasser-Krauss, Gabor Borocz, Edina Gyimesi, Lisa Wurzinger, Thomas Schlömicher, Gabor Soos, Dániel Ficzer, Viktor Tihanyi, Zsolt Szalay, Attila Földi</i>	
A Proposed Safety Case Framework for Automated Vehicle Safety Evaluation.....	190
<i>Jeffrey Wishart, Junfeng Zhao, Braeden Woodard, Gavin O'Malley, Hencong Guo, Shujauddin Rahimi, Sunder Swaminathan</i>	
Terrain Depth Estimation for Improved Inertial Data Prediction in Autonomous Navigation Systems.....	197
<i>Norbert Markó, Tamás Szirányi, Áron Ballagi</i>	
Statistical Consideration of the Representativeness of Open Road Tests for the Validation of Automated Driving Systems.....	203
<i>Jacob Langner, Romy Pohl, Joshua Ransiek, Philip Elspas, Eric Sax</i>	
System Design and Validation of a Decentralized Automated Vehicle Compute System for Energy Efficiency.....	211
<i>Aadi Kothari, Ryan Gerdes, Thomas Billington, Rohan Jaggannagari</i>	
Lithium-Ion Battery State of Charge Estimation by $L_1$ Robust Observer.....	216
<i>Heran Shen, Xingyu Zhou, Hyunjin Ahn, Yung-Chi Kung, Junmin Wang</i>	
Impact of Solar Radiation and Ambient Temperature on the Early Lifetime Estimation of an Automotive LIDAR.....	222
<i>Stephanie Grubmüller, Pamela Innerwinkler, Marlies Mischinger-Rodziewicz, Selim Solmaz, Horst Lewitschnig, Konstantin Posch</i>	
From Simulation to the Race Track: Development, Testing, and Deployment of Autonomous Racing Software.....	228
<i>Markus Schratter, Martin Kirchengast, Max Ronecker, Sebastian Riepl, Tobias Renzler, Daniel Watzenig</i>	
A Study on the Paradigm Shift in the Validation of Automated Vehicles.....	236
<i>Tobias Düser, David Fischer, Jonas Freyer</i>	
RotICP: A Spherical-Based Distance Algorithm for Rotation Search and Point Cloud Registration.....	242
<i>Kenan Ahmic, Adnan Tahirovic, Daniel Watzenig, Michael Stolz</i>	
Data-Driven Defenses Against Adversarial Attacks for Autonomous Vehicles.....	250
<i>Omar A. Azim, Lex Baker, Reek Majumder, Abyad Enan, Sakib M. Khan, Mashrur A. Chowdhury</i>	
Energy-Centric Cooperative Onramp Merging Strategy: An Analytical Solution.....	255
<i>Zejiang Wang, Anye Zhou, Adian Cook, Yunli Shao, Guanhao Xu, Max Chen</i>	
Validation Process of the Computer Simulation of a Test-Purpose Self-Driving Vehicle.....	262
<i>Rudolf Krecht, Miklós Unger, Áron Ballagi</i>	
Remaining Driving Range Estimation of Medium-Duty Electric Trucks During Delivery.....	267
<i>Hyunjin Ahn, Xingyu Zhou, Heran Shen, Yung-Chi Kung, Junmin Wang</i>	

Unveiling the Road Ahead: An MPC-Based Approach for Autonomous Intersection Navigation with Occlusion.....	273
<i>Zheyu Zhang, Jingjing Jiang, Wen-Hua Chen</i>	
Risk Monitoring and Mitigation for Automated Vehicles: A Model Predictive Control Perspective .....	279
<i>Kailin Tong, Fengwei Guo, Selim Solmaz, Martin Steinberger, Martin Horn</i>	
Learn to Race: Sequential Actor-Critic Reinforcement Learning for Autonomous Racing.....	286
<i>Ran Liu, Weichao Zhuang, Feifan Tong, Guodong Yin</i>	
Safe Planning with Game-Theoretic Formulation, Reachability Analysis and Reinforcement Learning .....	292
<i>Xu Shang, Shahabedin Sagheb, Azim Eskandarian</i>	
Model Validation of Adaptive Cruise Control in Vehicles Utilizing Real-World Driving Data .....	300
<i>Yaozhong Zhang, Jihun Han, Namdoo Kim, Dominik Karbowski</i>	
Lane Change Trajectory Prediction Based on Chinese Highway Ramp Scenarios .....	306
<i>Chunlong Qiu, Shanxing Zhou, Haoji Liu, Weichao Zhuang, Chen Jiang, Feifan Tong</i>	
Context-Aware Policy for Route Planning and Feasible Vehicle Technologies.....	312
<i>David Kraus, Carolin Junk, Marco Stang, Eric Sax</i>	
Multi-User Real-Time Controllable Connected Cars Testing Platform.....	318
<i>Burak Senkus, Mujdat Soyturk</i>	
Hierarchical Control for Distributed Drive Electric Vehicles Considering Handling Stability and Energy Efficiency .....	324
<i>Xinxu Li, Guodong Yin, Yanjun Ren, Fanxun Wang, Ruiqi Fang, Ang Li</i>	
Path Tracking of Tracked Vehicle with Variable Preview Distance and Differential Compensation.....	330
<i>Xin Bai, Guodong Yin, Fanxun Wang, Yanjun Ren, Tong Shen, Zhangcheng He</i>	
Research on Fuzzy Logic Adaptive Sliding Mode Control for Autonomous Vehicles Considering Road Roll Angle .....	336
<i>Ang Li, Guodong Yin, Fanxun Wang, Tong Shen, Ruiqi Fang, Xinxu Li</i>	
A Novel Robust Full-Speed Adaptive Cruise Control for Intelligent Vehicles.....	342
<i>Yanjun Ren, Tong Shen, Fanxun Wang, Mingzhuo Zhao, Xin Bai, Guodong Yin</i>	
Sideslip Angle Estimation of Uncertain Vehicle System Based on Robust Extended Kalman Filter.....	348
<i>Zhangcheng He, Guodong Yin, Yanjun Ren, Tong Shen, Jinxiang Wang, Ruiqi Fang</i>	
A Bootstrapped DQN-Based Decision-Making Method for Autonomous Driving Vehicles.....	354
<i>Yinglei Wang, Jinhao Liang, Yanbo Lu, Guodong Yin</i>	
An X-In-the-Loop (XIL) Testing Framework for Validation of Connected and Autonomous Vehicles .....	360
<i>Prakhar Gupta, Rongyao Wang, Tyler Ard, Jihun Han, Dominik Karbowski, Ardalan Vahidi, Yunyi Jia</i>	
Digital Twin of Physical Intersection to Trajectorybased Traffic Signal Controller.....	366
<i>Andalib Shams, Christopher M. Day, Shoaib Mahmud</i>	
Dynamic Collaborative Path Planning for Remote Assistance of Highly-Automated Vehicles .....	372
<i>Domagoj Majstorovic, Frank Diermeyer</i>	

Safety-Critical Lane Change Control of Autonomous Vehicles on Curved Roads Based on Control Barrier Functions .....	378
<i>Zehua Shi, Haoji Liu, Ziyi Liu, Tingting Li, Zhe Shi, Weichao Zhuang</i>	
Real-Life Implementation and Comparison of Authenticated Path Following for Automated Vehicles Based on Galileo OSNMA Localization .....	386
<i>Selim Solmaz, Georg Nestlinger, Karl Diengsleder-Lambauer, Roman Lesjak, Susanne Schweitzer, José M. Vallet García</i>	
On the Validation of Adversarial Threats to Cooperative Unmanned Aerial Systems for Search and Rescue Missions .....	392
<i>Linda Capitol, Keith A. Redmill</i>	
Personalized Electric Vehicle Range Prediction Based on Self-Supervised Driving Pattern Clustering .....	399
<i>Magdy Abdullah Eissa, Pingen Chen</i>	
Use of Connected Vehicle Data to Identify Signal Timing Plans on Signalized Arterial Corridors .....	405
<i>Shoaib Mahmud, Tingting Huang, Anuj Sharma, Christopher M. Day</i>	
Threats of Trojan Incursion in Transportation Hardware .....	411
<i>Jean Michel Tine, Sefatun-Noor Puspa, Reek Majumder, Gurcan Comert, Mashrur Chowdhury, Yingjie Lao</i>	

**Author Index**