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Systems & Control Engineering

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Section Information:

The Systems and Controls section provides the field of electrical and computer engineering a unified paradigm for designing controllers in a variety of application domains. Initially developed in the context of electrical engineering, this dynamic field has come to represent an essential enabling and supporting technology for a wide range of sectors (energy, transport, manufacturing, biology, defense, robotics …).

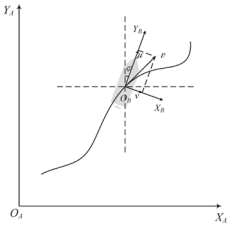
This section is devoted to publishing focused articles related to control aspects of electronics and engineering systems, more specifically including theoretical developments and applications of control engineering as embedded control systems, mechatronics, smart systems, power systems, electrical circuits, computer science, for the enhancement of electronics systems and processes. All submissions are subject to a peer-review process. We encourage the submission of original contributions derived from theoretical and/or application-oriented research studies.

Selected Papers

DOI:10.3390/electronics11050726

A Novel Fixed-Time Trajectory Tracking Strategy of Unmanned Surface Vessel Based on the Fractional Sliding Mode Control Method

Authors: Dong Chen, Jundong Zhang and Zhongkun Li

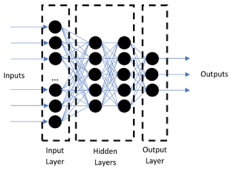


Abstract: A novel sliding mode control method is proposed to achieve the trajectory tracking of the Unmanned Surface Vessel (USV) and effectively deal with the unmodeled dynamics and external unknown disturbances. First, a fixed-time fractional-order sliding mode control (FTFOSMC) strategy is proposed, combined with the fixed-time control theory and fractional-order control theory based on the sliding mode control method. The FTFOSMC strategy can improve the convergence velocity of the system, and effectively track the desired path, weakening the "chattering" effect in sliding mode control systems. Second, a fixed-time fractional-order sliding mode control strategy combined with the radial basis function neural network (RBF-FTFOSMC) was designed, which can effectively estimate the lumped uncertainties, such as the disturbance of external wind, wave, and current, and the unmodeled dynamics of the USV model. Then, the stability and effectiveness of the designed control strategy are guaranteed by the Lyapunov theory and the corresponding lemmas. Finally, a rigorous simulation experiment is designed to validate the effectiveness and stability of the proposed control strategy. The simulation results show that the control strategy can effectively achieve trajectory tracking of the USV, reduce the "chattering" phenomenon of sliding mode, and effectively estimate the lumped uncertainties.

DOI:10.3390/electronics11152301

Review of Collision Avoidance and Path Planning Algorithms Used in Autonomous Underwater Vehicles

Author: Rafał Kot



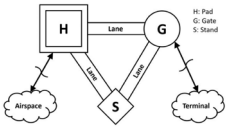
Abstract: The rapid technological development of computing power and system operations today allows for increasingly advanced algorithm implementation, as well as path planning in real time. The objective of this article is to provide a structured review of simulations and practical implementations of collision-avoidance and path-planning algorithms in autonomous underwater vehicles (AUVs). The novelty of the review paper is to consider not only the results of numerical research but also the newest results of verifying collision-avoidance and path-planning algorithms in real applications together with a comparison of the difficulties encountered during simulations and their practical implementation. Analysing the last 20 years of AUV development, it can be seen that experiments in a real environment are dominated by classical methods. In the case of simulation studies, artificial intelligence (AI) methods are used as often as classical methods. In simulation studies, the APF approach is most often used among classical methods, whereas among AI algorithms reinforcement learning and fuzzy logic methods are used. For real applications, the most used approach is reactive behaviors, and AI algorithms are rarely used in real implementations. Finally, this article provides a general summary, future works, and a discussion of the limitations that inhibit the further development in this field.

DOI:10.3390/electronics11071071

Vertiport Operations Modeling, Agent-Based Simulation and Parameter Value Specification

Authors: Lukas Preis and Mirko Hornung

Abstract: Urban air mobility (UAM) is the idea of creating a future mobility market through the introduction of a new mode of aerial transport with substantial travel time advantages. A key factor diminishing travel time savings is vertiport processes. So far, vertiport throughput capacity has only been studied in a static manner using analytical methods, which has been found to be insufficient. This paper wants to increase the level of understanding of operational dynamics on vertiport airfields by being the first to apply agent-based simulation. For this purpose, an existing vertiport model consisting of pads, gates and stands was refined through two means. First, a sensitivity study with over 100 simulations was executed shedding light on the driving processes on a vertiport airfield. Second, an expert interview series with 17 participants was conducted, letting the experts evaluate the model and specify relevant parameter values. Three main results should find mention here: (1) Pad operations were identified to be most impactful on passenger delays. (2) Pad and gate processes have a threshold capacity beyond which delays increase exponentially. (3) A refined vertiport model is presented, including the 27 most relevant parameters and their value specification. In conclusion, this paper finds that optimized vertiport airfield design is crucial to UAM operations, and dynamic passenger and vehicle interactions cannot be neglected.



DOI:10.3390/electronics11010145

Analysing Factory Workers' Acceptance of Collaborative Robots: A Web-Based Tool for Company Representatives

Authors: Marco Baumgartner, Tobias Kopp and Steffen Kinkel

Abstract: Collaborative robots are a new type of lightweight robots that are especially suitable for small and medium-sized enterprises. They offer new interaction opportunities and thereby pose new challenges with regard to technology acceptance. Despite acknowledging the importance of acceptance issues, small and medium-sized enterprises often lack coherent strategies to identify barriers and foster acceptance. Therefore, in this article, we present a collection of crucial acceptance factors with regard to collaborative robot use at the industrial workplace. Based on these factors, we present a web-based tool to estimate employee acceptance, to provide company representatives with practical recommendations and to stimulate reflection on acceptance issues. An evaluation with three German small and medium-sized enterprises reveals that the tool's concept meets the demands of small and medium-sized enterprises and is perceived as beneficial as it raises awareness and deepens knowledge on this topic. In order to realise economic potentials, further low-threshold usable tools are needed to transfer research findings into the daily practice of small and medium-sized enterprises.

Invitation to submit

Advances in Internet of Things Sensors
Guest Editors: Dr. Mingjing Cai, Dr. Mingyi Liu, Prof. Dr. Biao Wang and Dr. Xin Li
Deadline: 15 April 2024

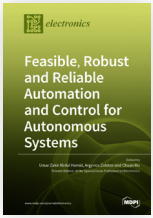
Reliability and Resilience Analysis of UAV Systems
Guest Editors: Dr. Guanghan Bai and Dr. Jia Wang
Deadline: 16 April 2024

Model Predictive Control: Future Trends and Advances in Motors
Guest Editors: Dr. Imed Jlassi and Prof. Dr. Antonio J. Marques Cardoso
Deadline: 15 May 2024

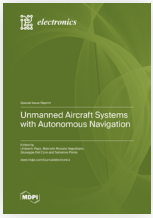
State-of-the-Art Research in Systems and Control Engineering
Guest Editors: Prof. Dr. Shuncong Zhong and Prof. Dr. Len Gelman
Deadline: 15 May 2024

Multi-Agent Systems: Planning, Perception and Control
Guest Editor: Dr. Arman Dabiri
Deadline: 15 May 2024

Special Issue Books



Feasible, Robust and Reliable Automation and Control for Autonomous Systems



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