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Editorial

Control Design for Electric Vehicles

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The recent research in the field of electrical and autonomous vehicles is developing in exciting directions. This research facilitates the improvement in the safety, energy efficiency, comfort, and transport economy of these vehicles. The components of the research tasks are related to vehicle modeling, performance specifications, robust control, and machine learning. In this Special Issue, exciting papers with both theoretical and application-oriented results and methods that focus on the fields defined above are presented. Traditional model-based methods, new data-based methods with machine learning, and even attempts to integrate the two approaches appear. The papers which have been published in this Special Issue cover a wide spectrum.

The paper 'A Novel Data-Driven Modeling and Control Design Method for Autonomous Vehicles' presented by Fényes et al. [1] proposes a method for the integration of the model-based control design and the data-driven identification method. In the LPV (Linear Parameter Varying) control design, a machine learning algorithm is built, with which the scheduling parameters are identified. The resulting LPV-based vehicle model is used for the control design, which is motivated by the path tracking function of autonomous vehicles.

The paper 'Design Framework for Achieving Guarantees with Learning-Based Observers' presented by Németh et al. [2] proposes a novel framework for the design of learning-based observers. The purpose of the method is to guarantee the reduction in the observation error, even if the learning-based observer is not examined in all vehicle maneuvers. The observer design is integrated with a controller design, which leads to a joint robust controller–observer design structure.

A model-based design solution is presented by Basargan et al. [3] in their paper, 'LPV-Based Online Reconfigurable Adaptive Semi-Active Suspension Control with MR Damper'. The paper focuses on an online, reconfigurable, road-adaptive semi-active suspension. The reconfigurable controller has an LPV structure, in which a nonlinear static model of the semi-active magnetorheological damper is incorporated in such a way that the performance objectives and the dissipative constraints are also specified. The input saturation caused by the actuator is handled by the LPV model. The adaptivity of the proposed controller for the trade-off between performances is managed by using an external scheduling variable.

The paper 'Development of Online Adaptive Traction Control for Electric Robotic Tractors' presented by Sunusi et al. [4] provides a solution to an exciting application task. It presents the design steps from the modeling phase to traction control through wheel slip estimation, while the handling of the chattering phenomenon is also presented. The longitudinal wheel forces are estimated using a robust sliding mode observer. The estimation and control of the wheel slip are critical considerations in preventing loss of traction, minimizing power consumptions, and reducing soil disturbance. Experiments have also been conducted using an electrical vehicle testing platform.

I hope that reading these papers will be a pleasant experience for both interested theoretical and applied researchers. I wish you a pleasant read.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Citation: Gáspár, P. Control Design for Electric Vehicles. *Energies* **2022**, *15*, 4193. https://doi.org/10.3390/en15124193

Received: 3 June 2022
Accepted: 3 June 2022
Published: 7 June 2022

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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