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Intelligent Control for Sustainable Electric Mobility: Romania-China Cooperation in the e-MATS Project

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INVITED SPEECH

***Abstract*—Connected autonomous electric buses must coordinate lane changes and speed decisions with traffic signals and surrounding human-driven vehicles while accounting for energy consumption, passenger comfort and safety. This invited speech presents details on the Romania-China cooperation in the framework of the e-MATS project, with the Romanian financing from CNCS/CCCDI - UEFISCDI, project number ERANET-ENUAC-e-MATS, within PNCDI IV. The presentation starts with details on Politehnica University of Timisoara's research group, continues with results in the framework of the e-MATS project, and ends with conclusions. Two joint publications are highlighted. The milestones achieved by the project are: (i) complete the development and validation of energy system models that integrate transit charging demands with urban power grid constraints, (ii) develop a hierarchical framework for optimizing charging facilities coupled with the power grid, (iii) finalize robust scheduling and optimization strategies for electric public transit networks, (iv) complete user behavior studies and develop evaluation frameworks for multimodal transport systems, and (v) achieve breakthroughs in vehicle energy optimization and battery management systems. The project impact is threefold: (1) societal: optimization public transportation system, (2) economic: low costs for transit authorities, and (3) environmental: reduce emission and energy consumption by electric transit system. The presentation reviews the underlying vehicle and traffic signal models and illustrates the trajectory planning approach using simulation results. It next introduces recent results on spatial lattice-based dynamic programming, including the discrete state representation, admissible lane and speed transitions, backward Bellman recursion, forward trajectory reconstruction and an outer search over the desired yaw angle. Illustrative CarSim results are included.**

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Keywords—control, neural networks, optimization, reinforcement learning, servo systems, tower crane systems

SHORT BIO

Radu-Emil Precup is a Professor at Politehnica University of Timisoara (UPT), Romania, and a Senior Researcher and Head of the Data Science and Engineering Laboratory of the Center for Fundamental and Advanced Technical Research, Romanian Academy - Timisoara Branch. He is an IEEE Fellow, recognized for contributions to fuzzy and data-driven control of servo systems, and a corresponding member of the Romanian Academy. His research focuses on intelligent control, fuzzy systems, data-driven controller tuning and optimization, with applications in mechatronics, robotics and transportation. He combines control-theoretic analysis with computational intelligence and experimental validation. He coordinates UPT's contribution to the e-MATS project, supporting international cooperation on sustainable electric mobility, including partnerships with Chinese research teams. He is Editor-in-Chief of the Romanian Journal of Information Science and Technology. His distinctions include member of the US National Academy of Artificial Intelligence - NAAI, fellow of the International Academy of Artificial Intelligence Sciences, Doctor Honoris Causa titles from Óbuda University and Széchenyi István University, the Elsevier Scopus Award for Excellence in Global Contribution, and prizes from the Romanian Academy for contributions to control and optimization.

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