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Metaheuristic Algorithms and their Applications to Fuzzy Control, Fuzzy Modeling and Learning-based Control

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PLENARY SPEECH

***Abstract*—This plenary presentation highlights some of the results obtained by the Process Control Group of the Politehnica University of Timisoara, Romania, in the field of metaheuristic algorithms, and their applications to fuzzy control, fuzzy modeling, and learning-based control.**

The presentation covers general introductory aspects of optimization, fundamentals of metaheuristic algorithms for solving specific optimization problems, and representative applications implemented in the group's laboratories, with real-time validation against experimental results.

The results outlined in the presentation include various laboratory equipment such as pendulum crane systems, multitank systems, modular servo systems, twin rotor aerodynamic systems, magnetic levitation systems, anti-lock braking systems, mobile robots, magnetic levitation systems, active suspension systems, and shape memory alloy systems.

A representative simulated application dealing with an optimal speed control strategy for connected autonomous electric buses to improve schedule reliability while reducing energy consumption is given.

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Keywords—connected autonomous electric buses, fuzzy modeling and control, learning-based control, metaheuristic algorithms, optimization.

SHORT BIO

Radu-Emil Precup is currently with the Politehnica University of Timisoara (UPT), Romania, where he became a Professor in the Department of Automation and Applied Informatics, in 2000, and he is currently a Ph.D. supervisor in automation and systems engineering. Since 2022 he is also a senior researcher (CS I) and the head of the Data Science and Engineering Laboratory of the Center for Fundamental and Advanced Technical Research, Romanian Academy – Timisoara Branch, Romania. From 2016 to 2022, he was an Adjunct Professor within the School of Engineering, Edith Cowan University, Joondalup, WA, Australia. He is currently the director of the Automatic Systems Engineering Research Centre of the UPT. From 1999 to 2009, he held research and teaching positions with the Université de Savoie, Chambéry and Annecy, France, Budapest Tech Polytechnical Institution, Budapest, Hungary, Vienna University of Technology, Vienna, Austria, and Budapest University of Technology and Economics, Budapest, Hungary. He has been an associate editor of IEEE Transactions on Fuzzy Systems (2018-2022), and serves on the editorial boards of several prestigious journals, including IEEE Transactions on Cybernetics, Information Sciences (Elsevier), Engineering Applications of Artificial Intelligence (Elsevier), Applied Soft Computing (Elsevier), Expert Systems with Applications (Elsevier), Evolving Systems (Springer), Applied Artificial Intelligence (Taylor & Francis), Healthcare Analytics (Elsevier), and Communications in Transportation Research (Elsevier).

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