Autonomous Vehicle Navigation: From Behavioral to Hybrid Multi-Controller Architectures

By Lounis Adouane

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Improve the Safety, Flexibility, and Reliability of Autonomous Navigation in Complex Environments

Autonomous Vehicle Navigation: From Behavioral to Hybrid Multi-Controller Architectures explores the use of multi-controller architectures in fully autonomous robot navigation?even in highly dynamic and cluttered environments. Accessible to researchers and graduate students involved in mobile robotics and fully autonomous vehicle navigation, the book presents novel techniques and concepts that address different complex mobile robot tasks.

The author examines the development of reliable elementary controllers and proposes mechanisms to manage the interaction of these multi-controller architectures while addressing different constraints and enhancing metrics/criteria linked to the safety, flexibility, and reliability of the proposed control architectures. He covers the modeling of subtasks, reliable obstacle avoidance, appropriate stable control laws for target reaching/tracking, short- and long-term trajectory/waypoint planning, navigation through sequential waypoints, and the cooperative control and interaction of a group of mobile robots. The author's website provides MATLAB® and Simulink® source code of the main procedures related to the task modeling, planning, and control of mobile robots. It also includes videos showing the main simulations and experiments given in the text.

In addition to flexible and bottom-up construction, multi-controller architectures can be formally analyzed to achieve reliable navigation in complex environments. This book reveals innovative control architectures that can lead to fully autonomous vehicle navigation in these challenging situations.

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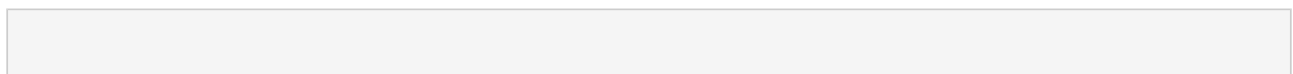
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Editorial Review

About the Author

Lounis Adouane is an associate professor at the Institut Pascal - Polytech Clermont-Ferrand in France. He received an MS in 2001 from IRCCyN-ECN Nantes, where he worked on the control of legged mobile robotics. In 2005, he obtained a PhD in automatic control from FEMTO-ST laboratory-UFC Besançon. During his PhD studies, he deeply investigated the field of multi-robot systems, especially those related to bottom-up and hybrid control architectures. Dr. Adouane's current research topics are related to both autonomous navigation of mobile robots in complex environments and cooperative control architectures for multi-robot systems. More specifically, his main research include planning and control, hybrid multi-controller architectures, obstacle avoidance, cooperative robotics, artificial intelligence (such as Markov decision process, multi-agent systems, and fuzzy logic), and multi-robot/agent simulation. He is the author/coauthor of more than 60 refereed international papers on these topics.

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