Title

From perception to planning and intelligence: A hands-on course on robotics design and development using MATLAB and Simulink

Presenters

Anastasia Mavrommati, Robotics Research Scientist, MathWorks
Roberto G. Valenti, Robotics Research Scientist, MathWorks

Abstract

The objective of this tutorial is twofold: providing an introductory course on robotics system design by exploring the key technologies that enable autonomy of a robotics system, and presenting solutions for practical design, implementation, and hardware deployment using MathWorks tools.

MATLAB® and Simulink® have long been used in many science and engineering disciplines and form the basis of coursework, tutorials, and laboratory experiments for many robotics curricula around the world. Recently, robotics problems have grown beyond the classical arm-manipulator kinematics into a broad spectrum of applications involving low-cost hardware such as Arduino, STM32, Raspberry Pi, education kits (LEGO) all the way to high-performance computing hardware such as General Processing units (GPUs) and Field Programmable Gate Arrays (FPGA) for fast, parallel, onboard processing. With new tools such as ROS Toolbox™, Navigation Toolbox™, Reinforcement Learning Toolbox™ as well as a variety of hardware support packages, MATLAB and Simulink provide an integrated software environment for developing robotic systems both in desktop simulation and on physical robots.

Over the course of the tutorial, accomplished professors will give lectures on different components of an advanced robotics system. Moreover, MathWorks engineers will provide hands-on solutions using MATLAB and Simulink and practical examples. The audience will have access to the tools through a temporary license to run and modify the provided examples.

Bios

Anastasia Mavrommati is a Senior Robotics Research Scientist at MathWorks in the Advanced Research & Technology Office. Previously, she worked as a Research Scientist within the Robotics department at the Schlumberger-Doll Research Center, where she developed robotic technologies and coordinated their deployment to oil & gas field operations, focusing on control of robotics manipulators and autonomous aerial inspection. Her research and technology interests include hybrid control, trajectory optimization, model predictive control, embedded deep learning, hardware-in-the-loop systems, and virtual reality simulation environments. She obtained her Ph.D. in Mechanical Engineering at Northwestern University, IL, USA, specializing in real-time algorithms for symbol-based automation with applications to real-time exploration and information acquisition for high-dimensional robots.

Dr. Mavrommati also has a M.S. from Northwestern University with a focus on human-in-the-loop assistive algorithms for rehabilitation therapy. She is the Chair of the IEEE RAS Boston Chapter.

Roberto G. Valenti is currently a Senior Robotics Research Scientist at MathWorks. His research interests include Robotics, robotics sensing for navigation, sensor fusion, mobile autonomous robots (self-driving cars, unnamed aerial vehicles), inertial navigation and orientation estimation, control, computer vision, and deep learning. Previously, he worked as a Research and Development Engineer within the Autonomous Driving team at Nvidia. He obtained a Ph.D. in Electrical Engineering at the City University of New York, The City College, NY, USA where he focused his research on state estimation and control for autonomous navigation of micro aerial vehicles. Dr. Valenti received his M.Sc. in Electronics Engineering from the University of Catania, Italy. He is a member of IEEE and RAS.