使用机器人系统工具箱开发智能算法

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日程

- 使用MATLAB 和 Simulink 在机器人领域
  - 开发机器人硬件系统
  - 开发机器人应用
  - 机器人教学

- Robotics System Toolbox 简介 (R2015a, March 2015)
  - 路径规划算法（Path Planning）
  - 障碍物防撞算法（Collision Avoidance）
  - MATLAB/Simulink与ROS接口
你在机器人领域做什么？

1. Build Robots
2. Develop Robotics Applications Using Existing Robots
3. Teach/Learn Robotics

My Focus Today
Using MATLAB and Simulink for “Building Robots”

Input + Controller - Output

Festo Bionic Arm

DLR Humanoid Robot

YZU Robot Hand

Recorded Webinar: How a Differential Equation Becomes a Robot
Using MATLAB and Simulink for “Teaching/Learning Robots”

**Build Robots with Low-Cost Hardware?**
- No need C/C++/Python
- Drivers Provided
- Comprehensive Algorithms

**Use Powerful Robots Running ROS?**
- ROS/Gazebo Interface
- ROS Node Generation
- Comprehensive Algorithms

**Hardware Support Package**

**Robotics System Toolbox**

Visit: [www.mathworks.com/hardware](http://www.mathworks.com/hardware)

Visit: [www.mathworks.com/products/robotics](http://www.mathworks.com/products/robotics)
Using MATLAB and Simulink for “Developing Robotics Applications”

- What you have and need?

  **Example:**
  Develop a Robot for Delivery

Developing Robotics Applications using Existing Robots

1: Interface
2: Algorithms

My computer + My MATLAB

My Robot
Key Features of Robotics System Toolbox (v1.0)

- MATLAB-ROS Interface
- Simulink-ROS Interface
- Robotics Algorithms
- Comprehensive Demos
Demos…

1. Design and Test Robotics Algorithms with ROS-enabled Robots or Simulators (such as Gazebo)
2. Generate ROS nodes from Simulink Models
Demo 1 Overview: Design and Test Robotics Algorithms

- Prototype algorithms (e.g., Path Planning) in MATLAB
- Test algorithms with ROS-enabled Simulators such as Gazebo
- Test algorithms on a Robot and analyze the performance with rosbag
Demo 1: Design and Test Robotics Algorithms

- Prototype a path-planning algorithm in MATLAB
Demo 1: Design and Test Robotics Algorithms

- Test it with Gazebo through MATLAB-ROS Interface
Demo 1: Design and Test Robotics Algorithms

- Test it with a physical robot running ROS
Demo 1: Design and Test Robotics Algorithms

- Analyze the performance by reading rosbag files
Demo 2 Overview: Generate a ROS Node from a Simulink Model

Prototype algorithms (e.g., Collision Avoidance) in Simulink

Test algorithms with a ROS-enabled Simulator or Robot

Generate a standalone ROS node from the Simulink Model
Demo 2: Generate a ROS Node from a Simulink Model

- Connect Simulink Model to a ROS network to simulate a Collision Avoidance algorithm
Demo 2: Generate a ROS Node from a Simulink Models

- Convert Simulink model to C++ code for a standalone ROS node
Demo 2: Generate a ROS Node from a Simulink Model

- Verify the generated ROS node
Key Capabilities Demonstrated

- **MATLAB-ROS Interface**
  - Create a ROS node inside MATLAB
  - Design and test robotics algorithms on a robot simulator such as Gazebo
  - Test robotics algorithms on a physical robot
  - Import rosbag log files into MATLAB

- **Simulink-ROS Interface**
  - Simulink I/O with ROS networks
  - ROS node generation from Simulink models

- **Algorithms in Robotics System Toolbox**
Robots Algorithms with Other MathWorks Products

**Computer Vision System Toolbox**

**Phased Array System Toolbox**
Thank You…

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