MATLAB meets Mindstorms

How to control Lego NXT robots using Matlab for educational purposes

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MATLAB MEETS MINDSTORMS 1/2

- Each NXT
  - can control 3 servo motors
  - interact with 4 sensors
MATLAB MEETS MINDSTORMS 2/2

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- Each NXT
  - can control 3 servo motors
  - interact with 4 sensors

- Variety of sensors

- pressure
- light
- sound
- ultrasonic
- gyro
- compass
- IR
- RGB
- acceleration
- distance
500 EE freshmen students each year @ RWTH Aachen University

First semester syllabus is packed with prosaic content
- Higher Mathematics
- Electrical Engineering I
- Physics I
- Computer Science I
- Discrete Signal Processing I

How to keep students motivated?
- Need for motivation of syllabus content
- Need for good delivery of programming skills
- Need for hands-on real-world experiences
- Need for team-work and soft skills
MATLAB MEETS MINDSTORMS MEETS EE FRESHMEN 2/2

- RWTH EE freshmen project
  - 9 days full-time programming and experimenting
  - 500 students at the same time, distributed among all institutes
  - RWTH Lego Mindstorms NXT Toolbox for Matlab

Mindstorms NXT Toolbox
Let’s get started!

What we are going to do

- Toolbox installation
- Establishing a connection
- Read sensors
- Control motors
- Robot application
LIVE IN-MATLAB (4 Min)

- Demonstrate how to download the Toolbox (TB)
- Installation of the TB into the Matlab path
- First USB connection to NXT
- First Bluetooth connection to NXT
- Hello World: Play_Tone
Live IN-MATLAB (5 Min)

- Handle the pressure sensor
- Handle the light sensor
- Handle the sound sensor
- Handle the ultrasonic sensor
Mindstorms NXT Toolbox

Reading the Sensors

What we are going to do

- Check if the pressure sensor is pushed
- Record sound from the sound sensor
- Get in touch with the light sensor
- Measure distances using the Ultrasonic sensor
Mindstorms NXT Toolbox
Controlling the Motors

What we are going to do

• How to create a new motor object
• How to control speed, distance and actions when stopping
• How to synchronize motors
Live IN-MATLAB (6 Min)

- Introduction to the motor class
- Explication of different operator modes and options
- Short annotations to "motorControl"
Put it all together: our first useful robot

- Robot who is trapped in box with only one exit
- Robot scans environment
- Finds exit using basic signal processing
- Rotates towards exit
- Drives forward to exit the box