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Identification procedure for Lego Mindstorm motor

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Abstract

Report for the first assignment on Applied robotics: getting and identification parameters of the Lego NXT motors.

In this report we discuss our method of obtaining data from Lego Mindstorm motors as well as estimation of parameters from the motor data.

1 Tools and definitions

1.1 General definition

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1.2 Used tools

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2 Collecting motor data

Have been used 2 different methods to collect motor data:

1. Bluetooth connection
2. Usb connection

It is important get the minimum time gap between measures, but it require an extra check to detect if the tachometer sensor is fast and precious as the used transmission. For this report is decider to use USB connection getting 10 different data files with different raw powers.

2.1 Bluetooth data collection

Given by the lab the code to comunicate between our PC and the NXT brick, we learned how it works and we implement the interface to include also the current measure NXT timestamp. The procedure to get data with bluetooth is the following:

1. Send message from PC to brick that set motor power
2. Send message from PC to brick that requests tachometer count from the motor
3. Receive message from brick with tachometer count and relative timestamps
4. Save timestamps and tachometer count to file
5. Repeat all from step 2

Using this methodology there is a very high latency $\approx 50ms$. It is possible to force the speed connection, but using USB connection it results more reliable and fast. Code is available here: <https://github.com/AliaksandrSiarohin/AppliedRobotics/brofist>

2.2 USB data collection

To establish a connection between PC and NXT brick is possible using a specific Python library called "pyusb". The procedure to get data with this method is the following:

1. Establish connection with brick using pyusb
2. Set up the motor power on the brick
3. Send (timestamp, tacho count) from PC to brick
4. Receive (timestamp, tacho count) from brick to PC
5. Save collected data to file
6. Go to step 3

Using this methodology is possible to obtain much better performance about $\approx 2ms$ latency. Code is available here: https://github.com/AliaksandrSiarohin/AppliedRobotics/usb_collector

3 Estimating the parameters from the data

To estimate the parameters we filter the data using butterworth filter and then we estimate the parameters using 2 methods:

- Regular method proposed on the lecture
- Regression method

3.1 Filtering

We use butterworth filter of order 1 and cut-off frequency 0.02. For example ??.

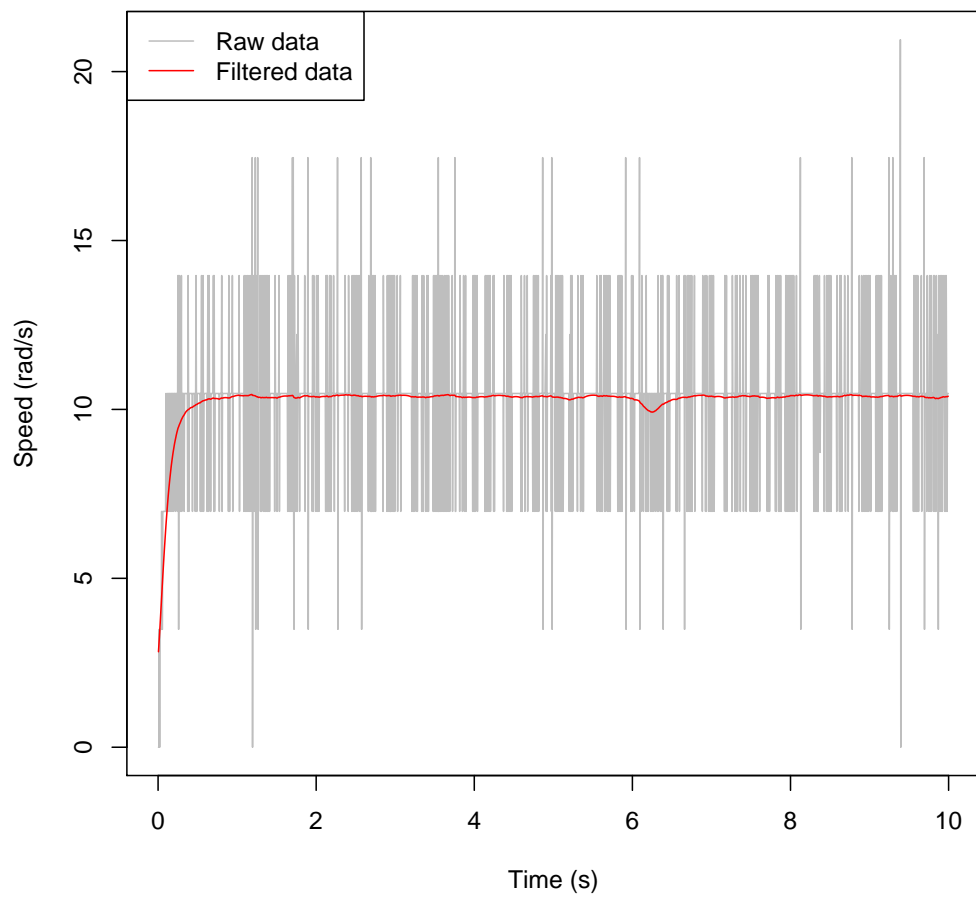


Figure 1: Deviation of x from its mean.