Data-Driven Control for DC motor

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Asset Malik
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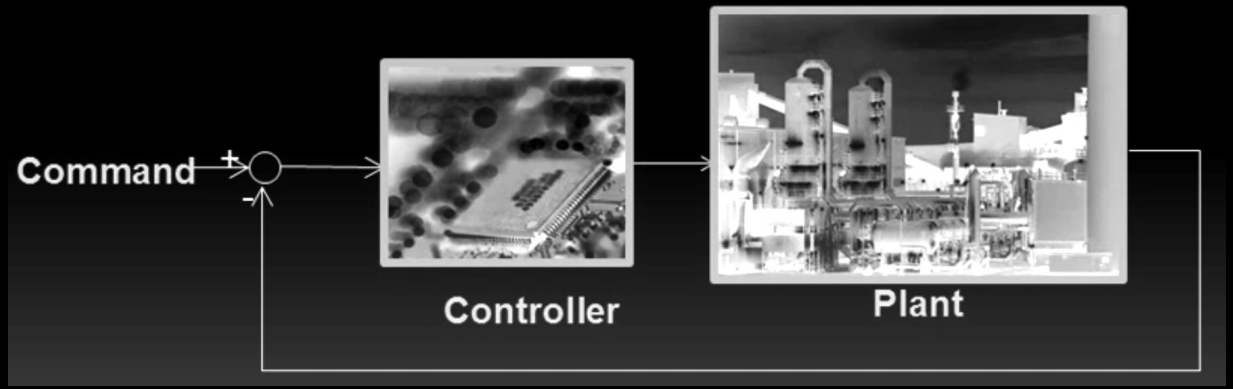
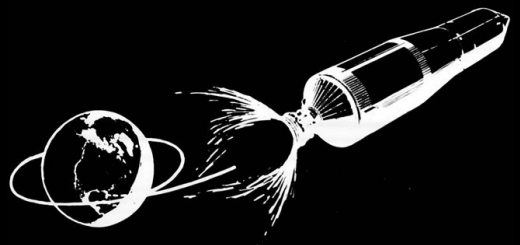
What is control theory?



Data-driven control. (n.d.). Retrieved February 18, 2021, from https://www.mathworks.com/matlabcentral/fileexchange/42758-data-driven-control

Motivation for Data-Driven approach



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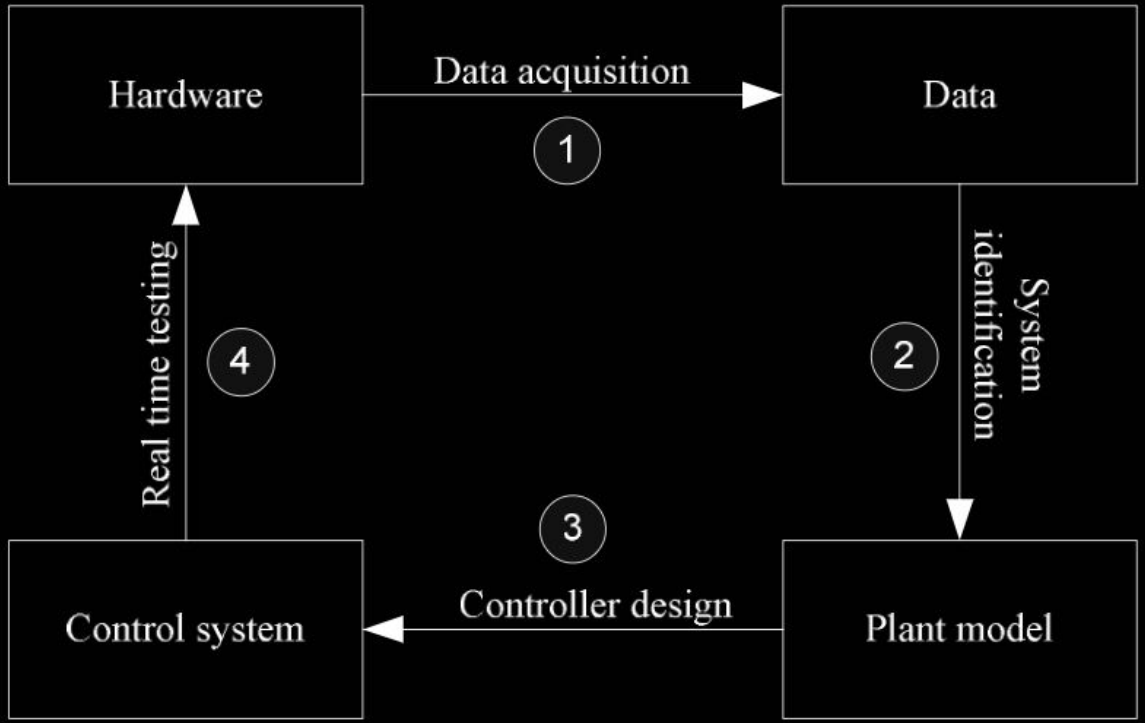
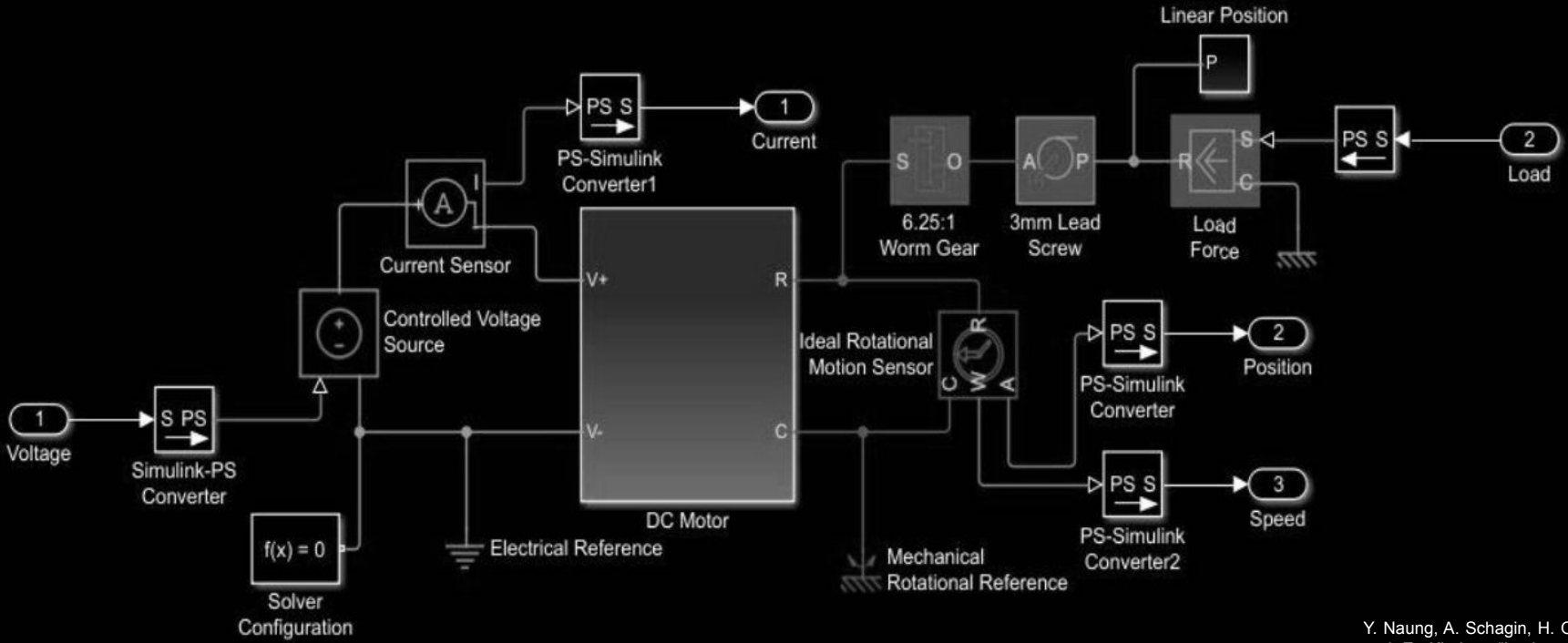
Data-Driven approach



Y. Naung, A. Schagin, H. Oo, K. Ye, and Z. Khaing, “Implementation of data driven control system of dc motor by using system identification process,” in 2018 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering

Related work
DDC for Simulated DC motors



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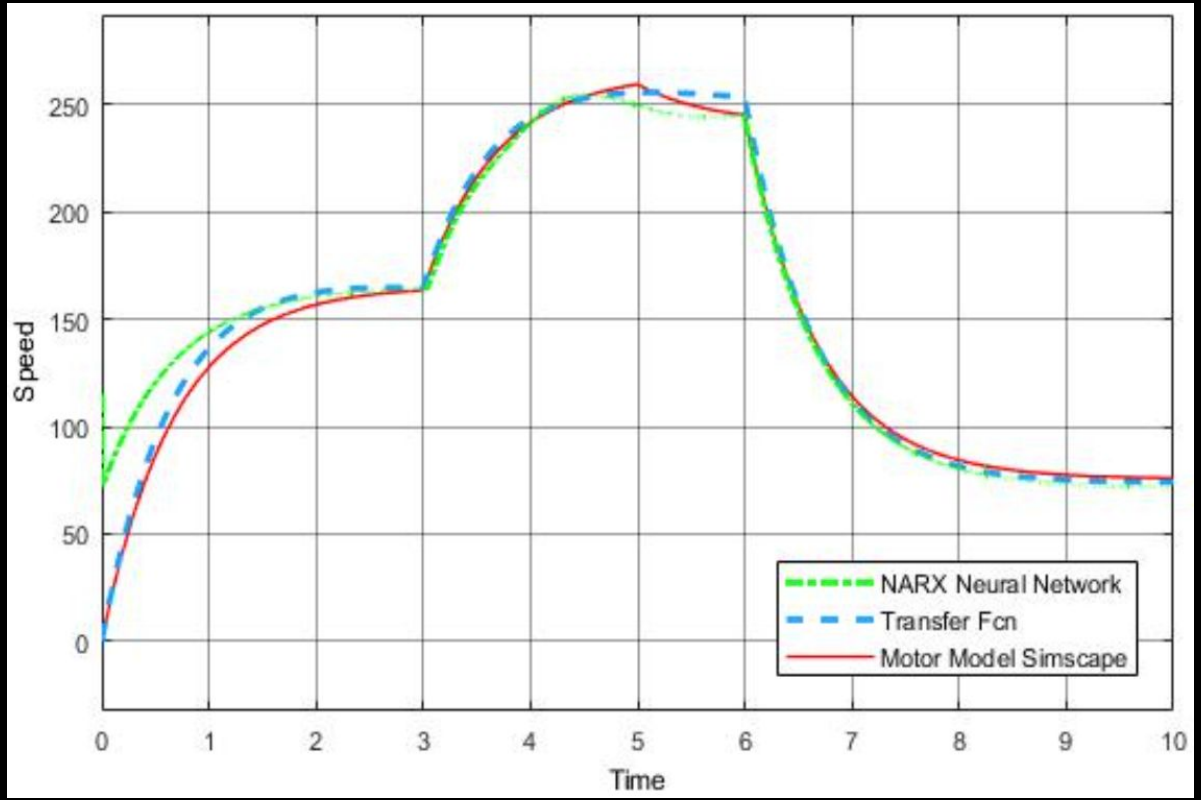
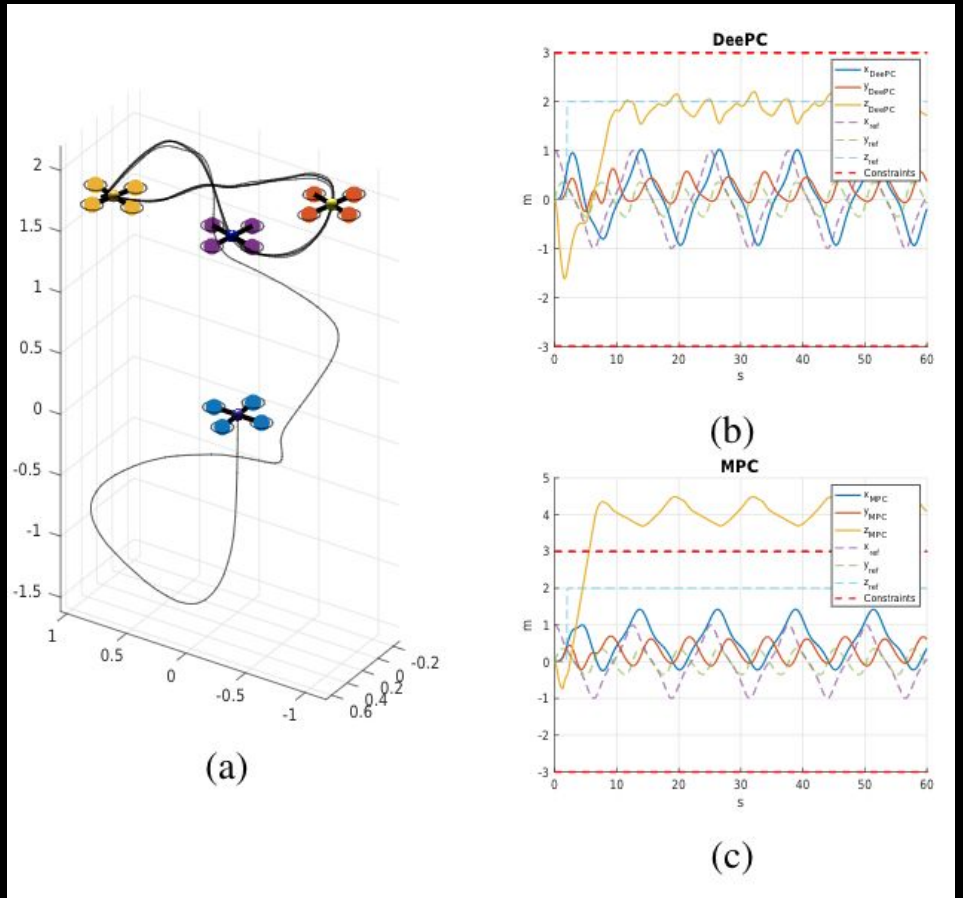
DeePC algorithm for real-time DDC



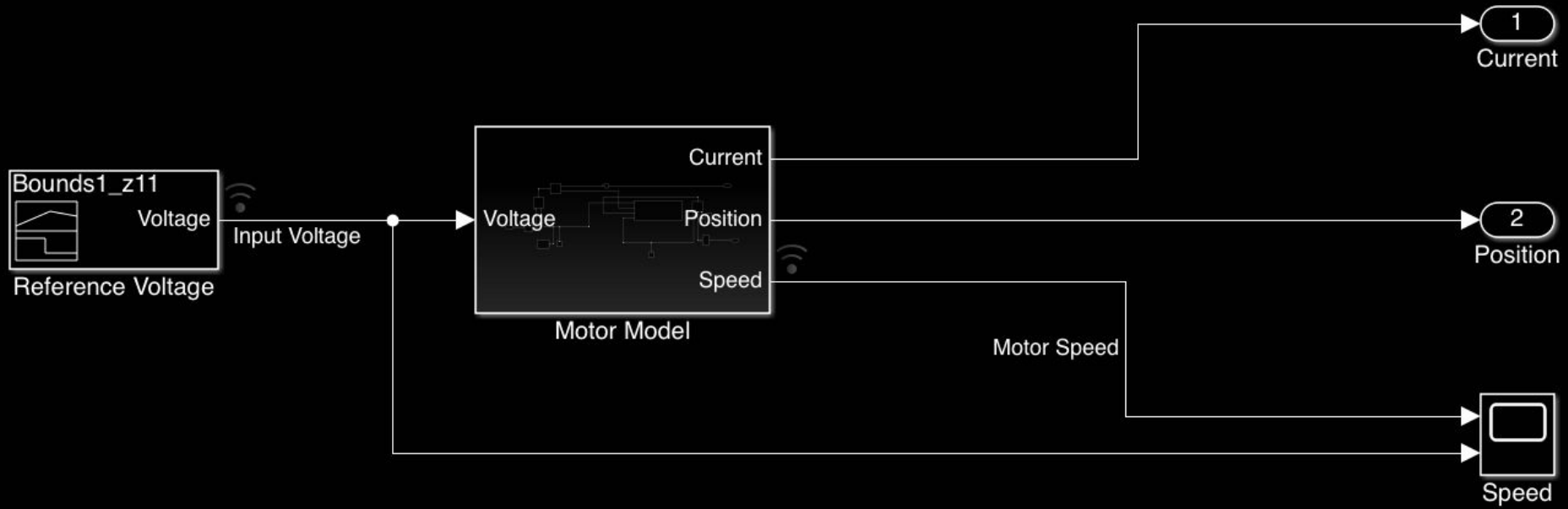
P. G. Carlet, A. Favato, S. Bolognani, and F. D¨orfler, “Data-driven predictive currentcontrol for synchronous motor drives,” in 2020 IEEE Energy Conversion Congress andExposition (ECCE), pp. 5148–5154, IEEE, 2020.

Real-Time Data Driven Predictive Control



J. Coulson, J. Lygeros, and F. D¨orfler, “Data-enabled predictive control: In the shallows of the deepc,” in 2019 18th European Control Conference (ECC) pp. 307–312, IEEE, 2019.

#1: Model for Data acquisition with MATLAB simulation



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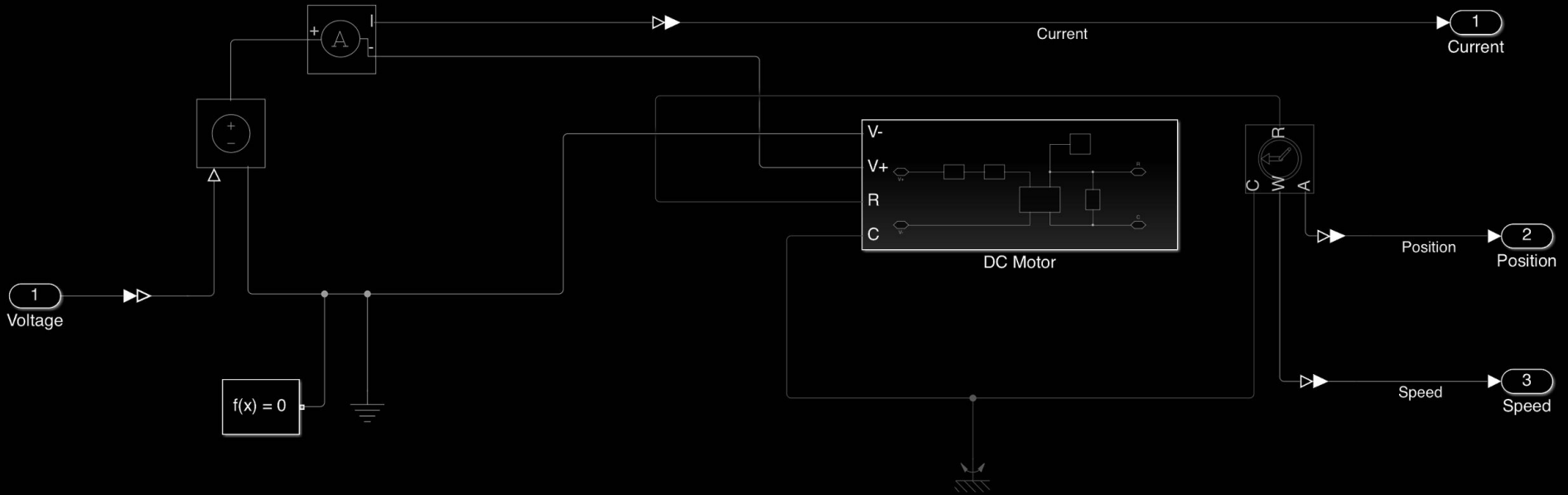
DC motor model in MATLAB simulation



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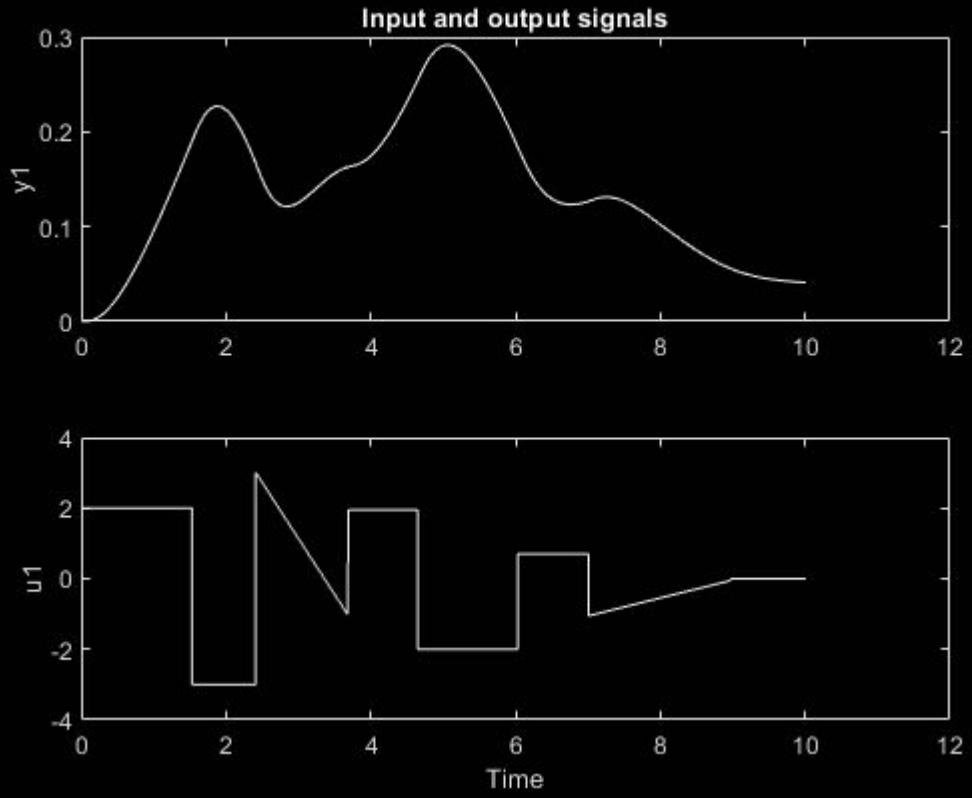
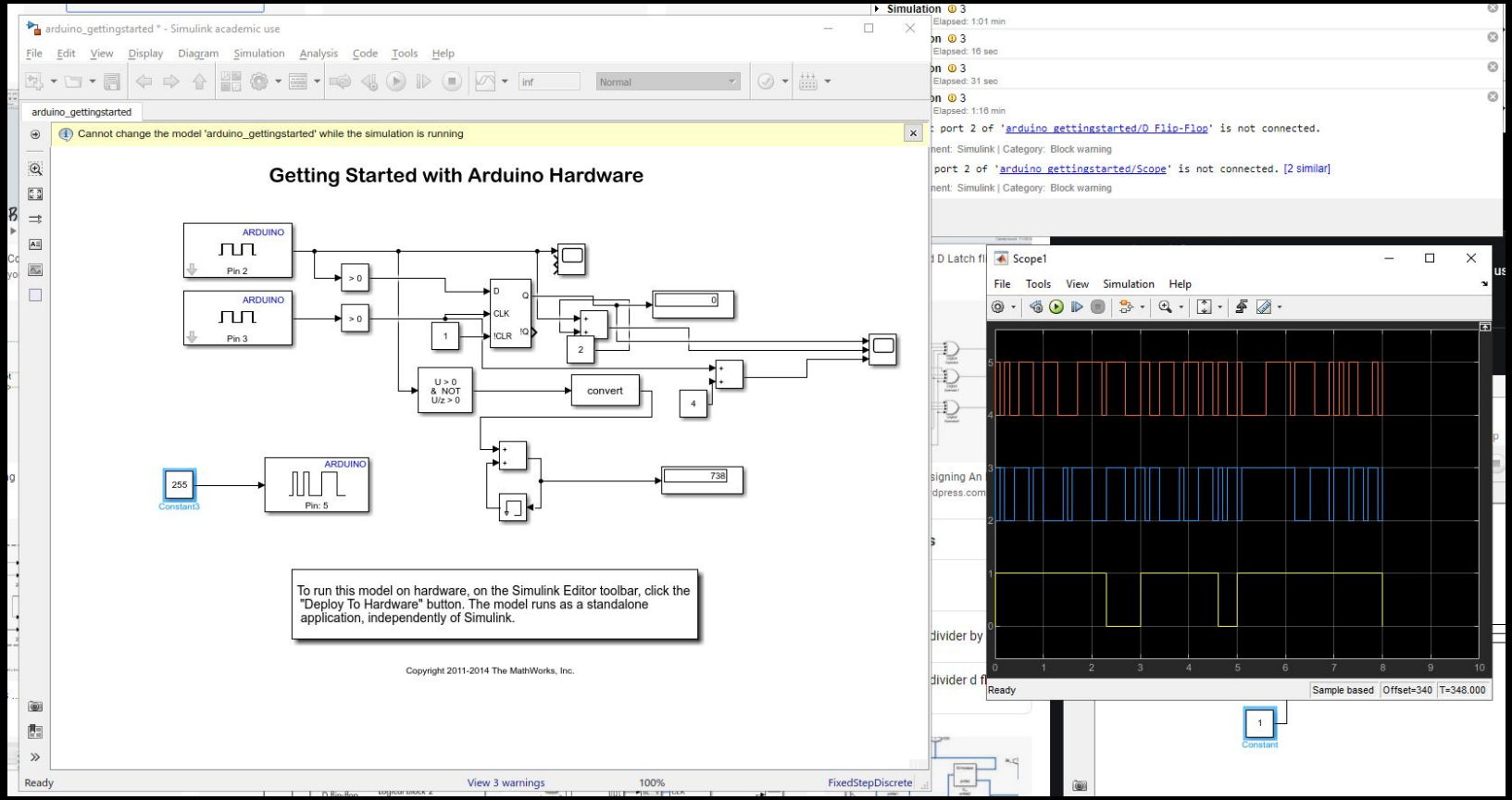
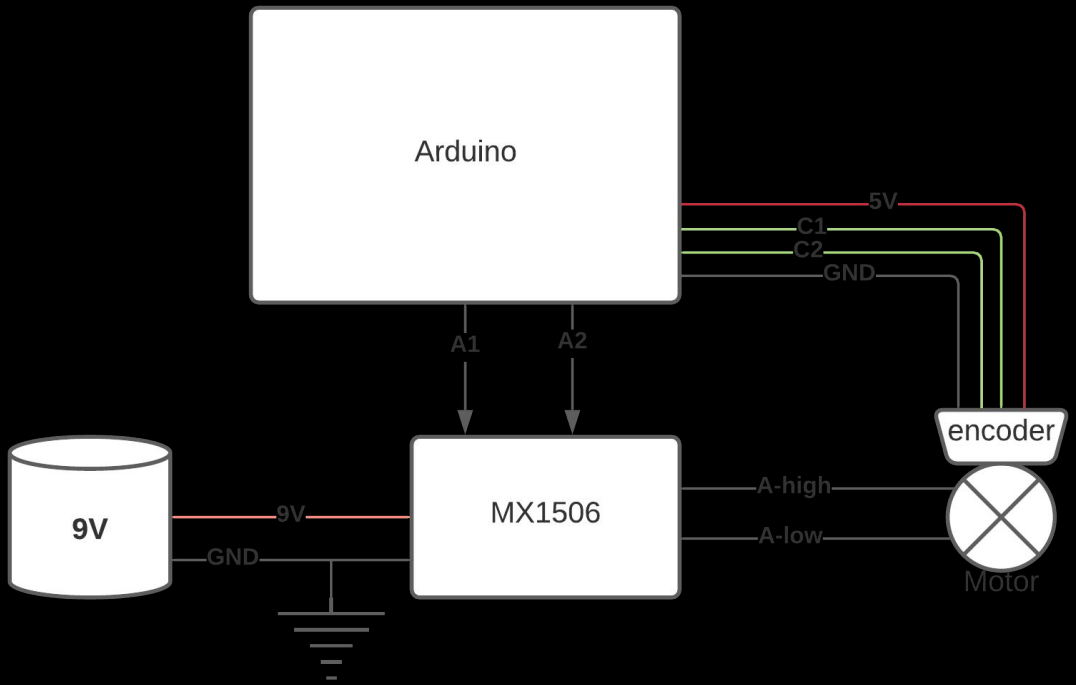
Sample of data acquisition experiment



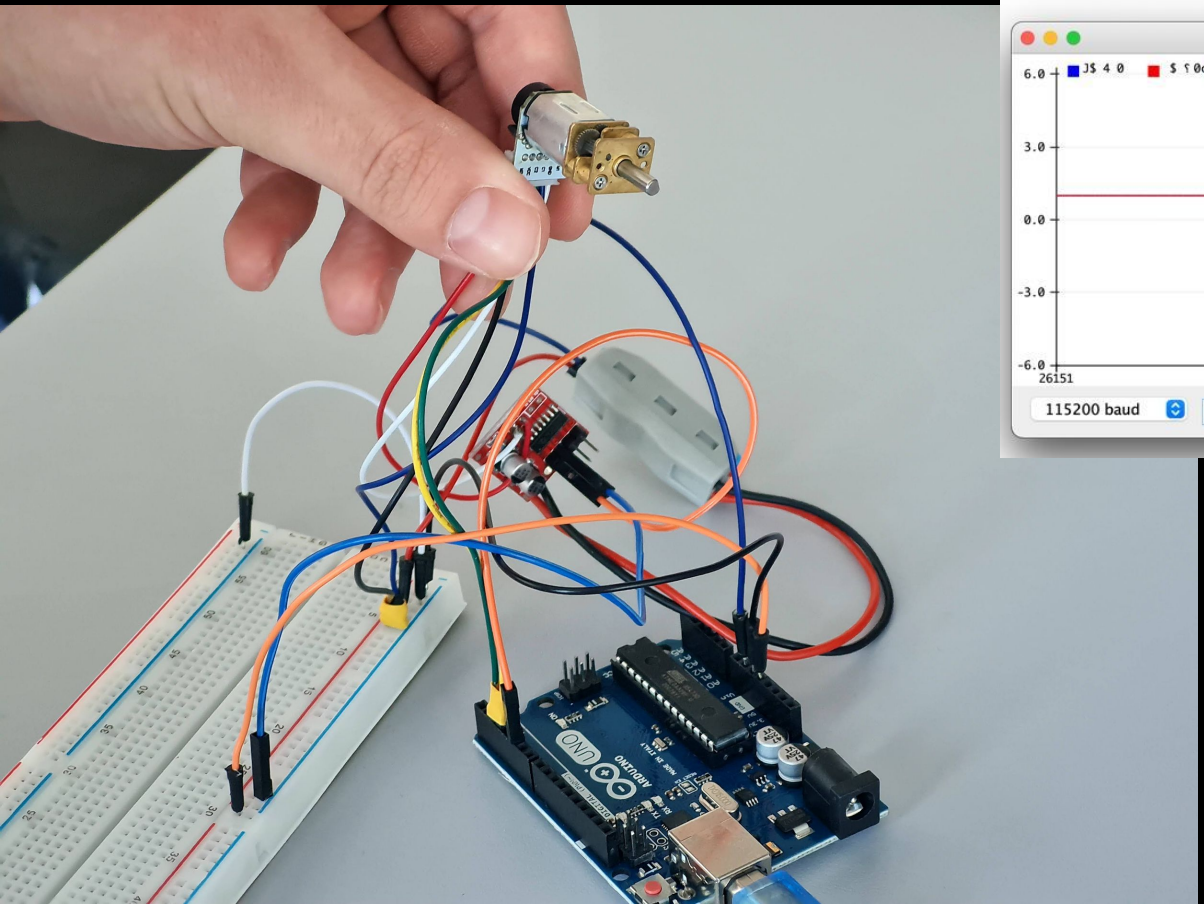
#2: Arduino Hardware

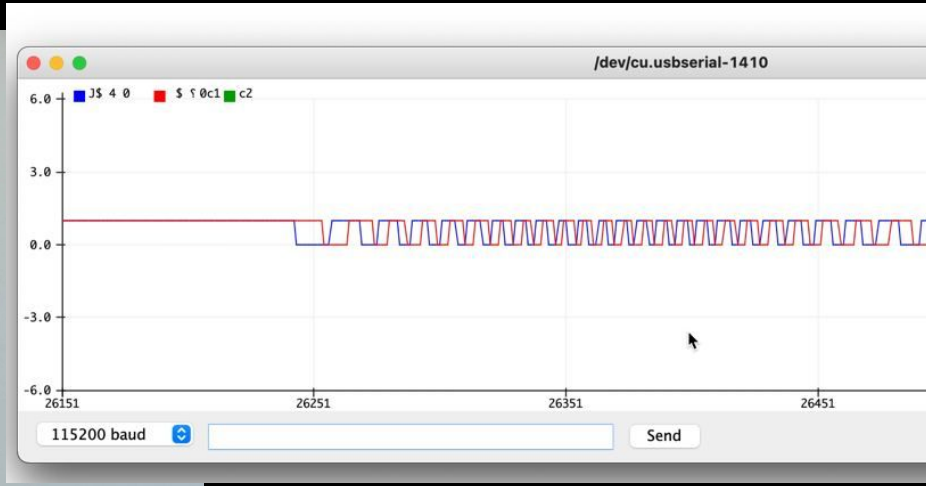


Arduino Hardware Setup #1

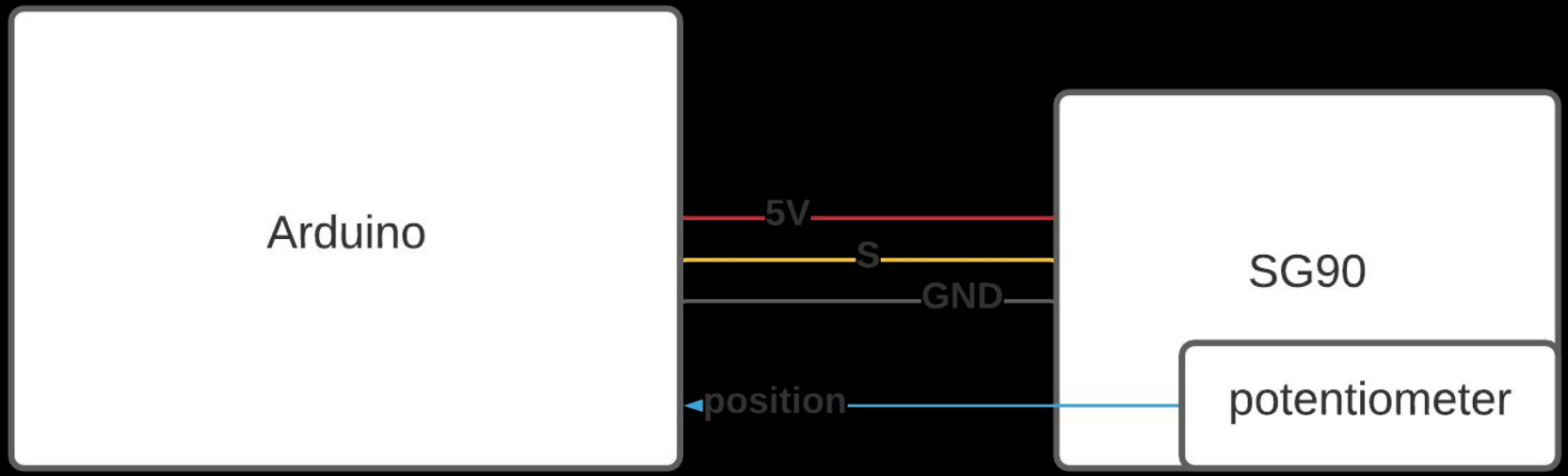


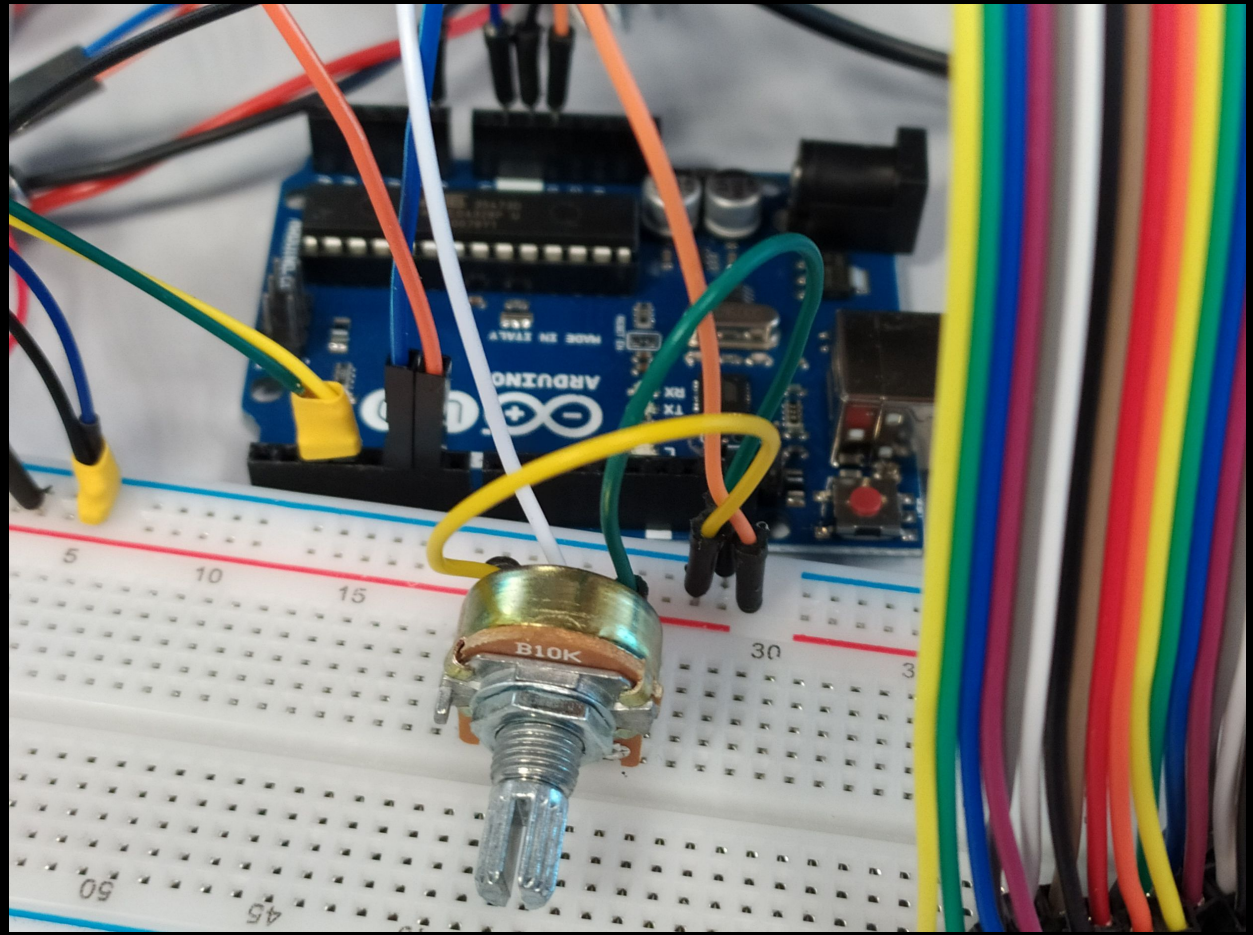
Arduino Hardware Setup #2





Arduino Hardware Setup #2

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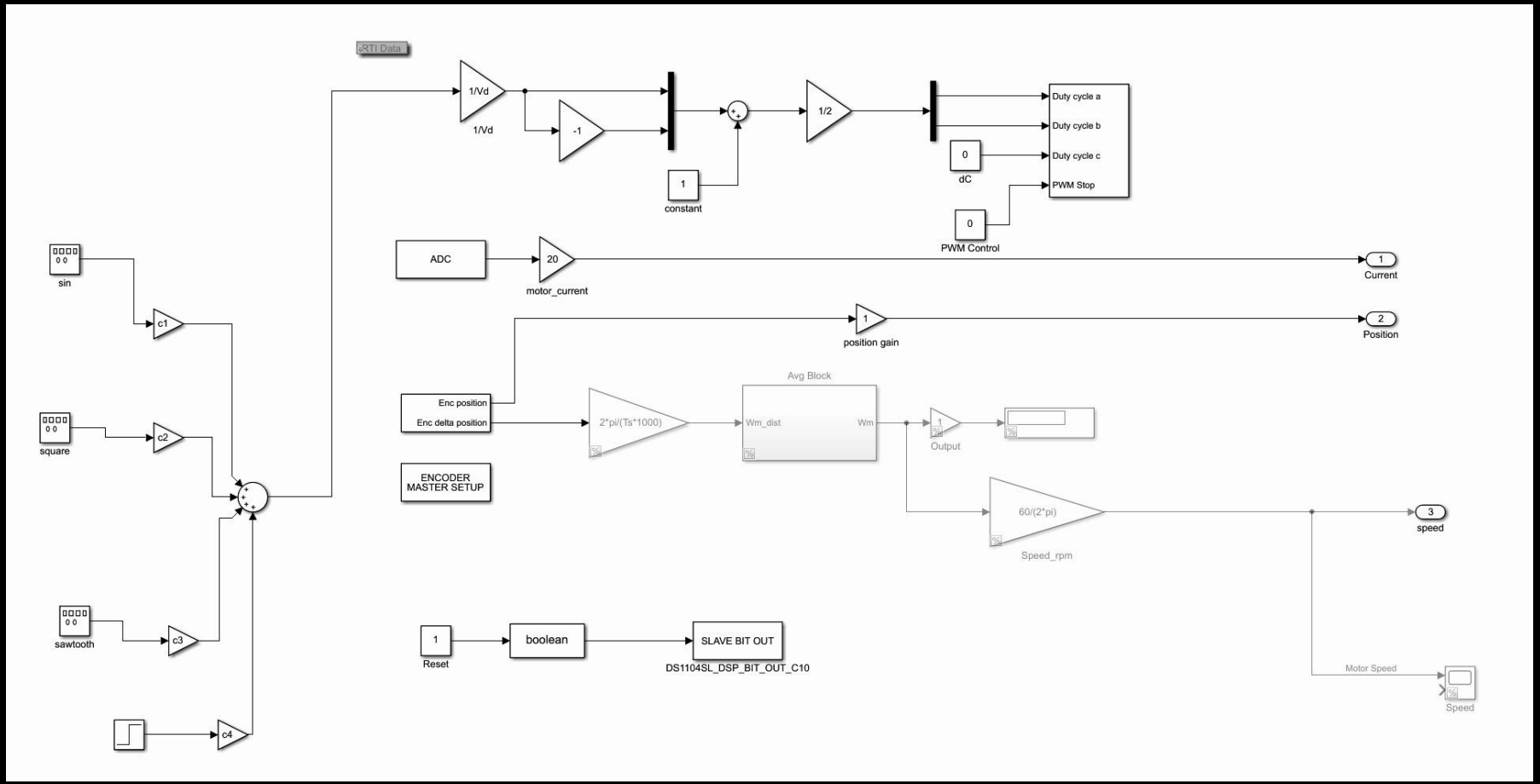
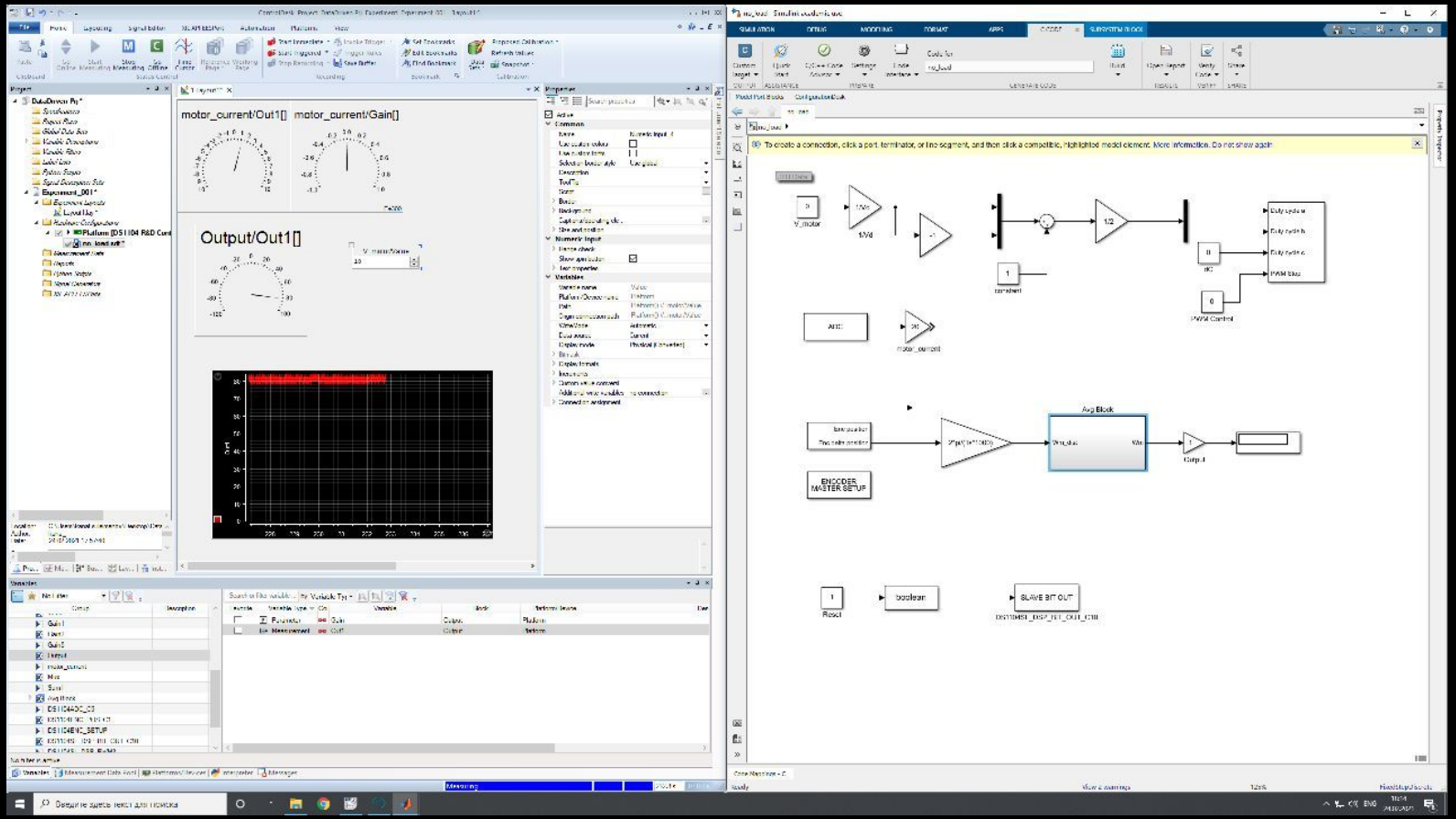
#3 dSpace Hardware setup

dSpace control model

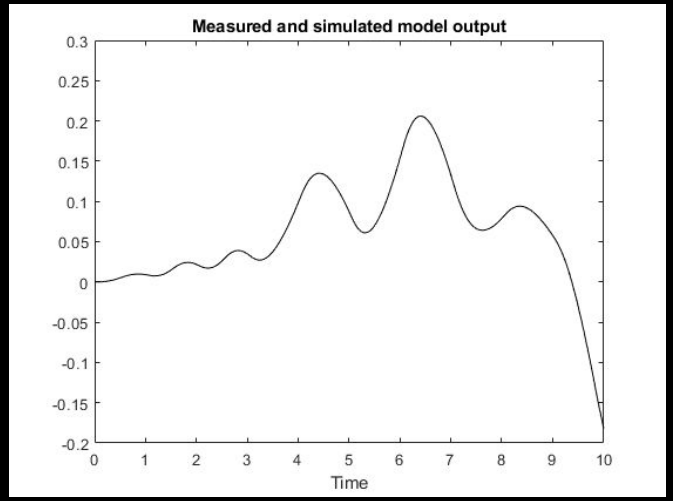


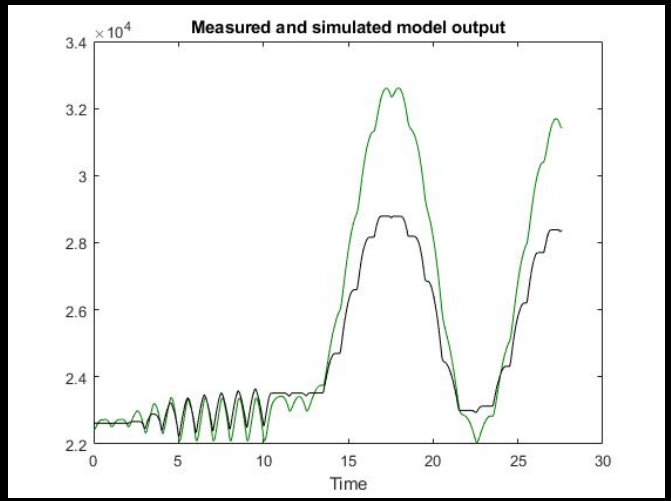
dSpace Model for data acquisition



Synthesized plant model Results

- MATLAB simulation - 97% accuracy, linear approximation
- Arduino setup - aliasing issue, further work needed
- dSpace setup - 73% accuracy, linear approximation





Conclusion and Future Work

- 4 different setups were built for DDC
- The acquired data was analyzed in MATLAB, controllers were synthesized

- **Next up:** fine tune the controller on dSpace
- Try another microcontroller setup
- In case of success, implement reinforcement learning based on microcontroller.