HZB Helmholtz Zentrum Berlin

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TEST BENCH FOR MOTOR AND MOTION CONTROLLER CHARACTERIZATION

David Kraft, Maxim Brendike

Helmholtz-Zentrum Berlin, Hahn-Meitner-Platz 1, 14109 Berlin

ABSTRACT: To maximize beamtime usage motorization of beamline equipment is crucial. Choosing the correct motor is complex, since performance depends largely on the combination of motor and motion controller[1]. This challenge, alongside renewing the twenty years old infrastructure at Bessy II, led to the demand for a motor test bench. The test bench was designed to be modular, so it fits different motors, loads and sensors. It allows independent performance verification and enables us to find a fitting combination of motor and motion controller. The test bench is operated via EPICS and BlueSky, allowing us usage of python for automated data acquisition and testing. An overview of the mechanical and electrical setup, as well as some data from different performance tests will be presented.

MOTIVATION

By positioning optical components, motors and their controllers play a crucial role in whether an experiment succeeds or fails. Many different controllers and motors are used in the experimental hall at BESSY II [2]. To determine how different combinations of motors and controllers perform, a test bench was built.

METHODS

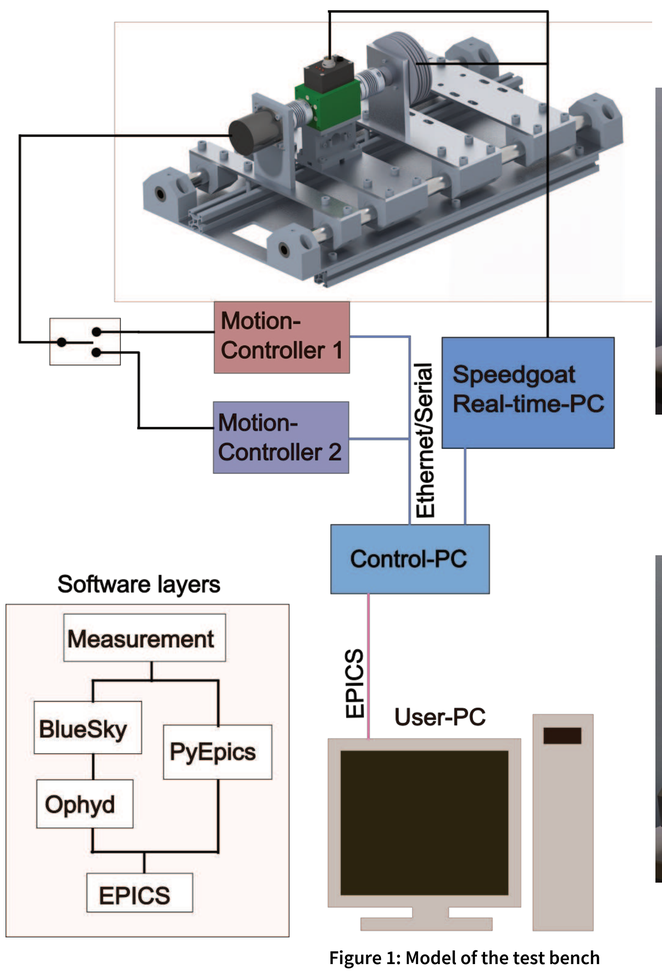

Figure 1: Model of the test bench

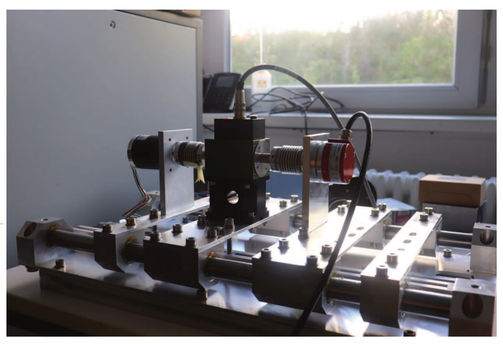

Figure 2: Setup for testing time resolved positioning

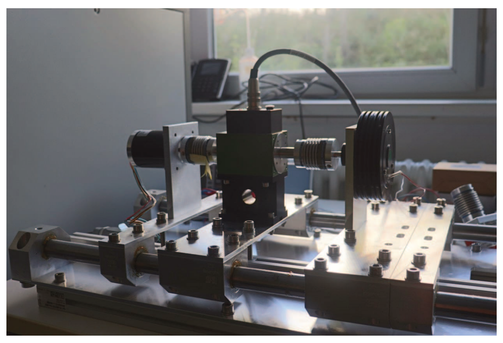

Figure 3: Setup for testing torque vs. velocity

Charactristics of the test bench
- Modular -> Suits different motors, loads and encoders
- Mobile -> Tests can be performed anywhere
- Simple -> Easy to build plates, combined with a 1 degree of freedom linear guiding

Possible test types
- Minimal increment motion
- Positioning with different µstep-settings
- Maximum torque with different µstep-settings
- Time resolved running behaviour

RESULTS

Parameters figure 4 + figure 5:
- 1500 mA run current / 1000 mA stop current
- Time for movement 1 sec -> Target 0.09° per µstep
- Open-loop motor positioning

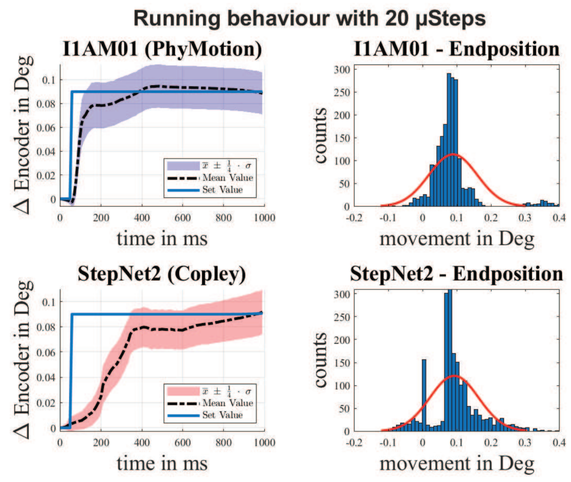

Figure 4: Running behaviour with 20 µsteps

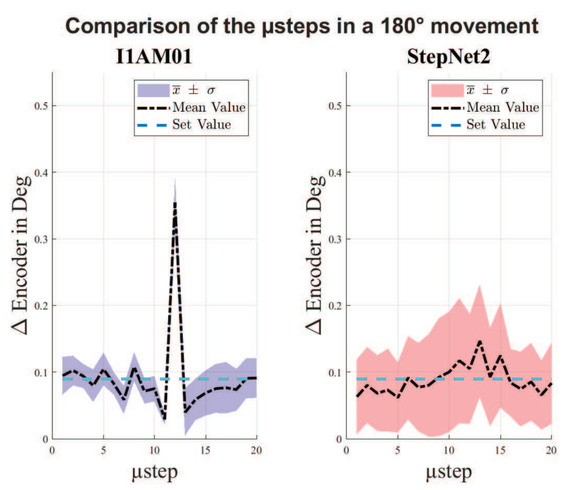

Figure 5: Encoderdelta for individual µsteps

Parameters figure 7:
- 1000 mA run current / 500 mA stop current

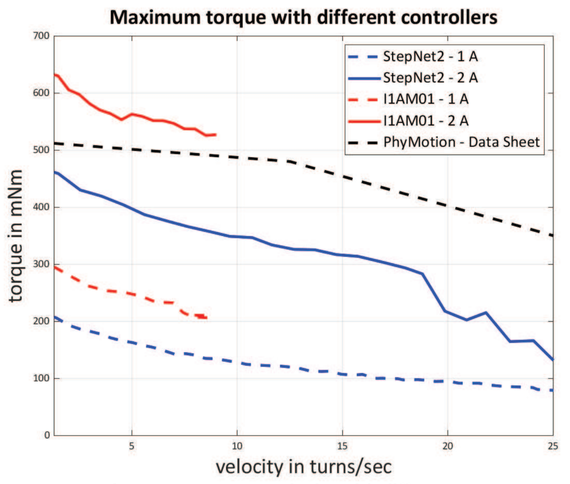

Figure 6: Torque vs. velocity with different motorcurrents

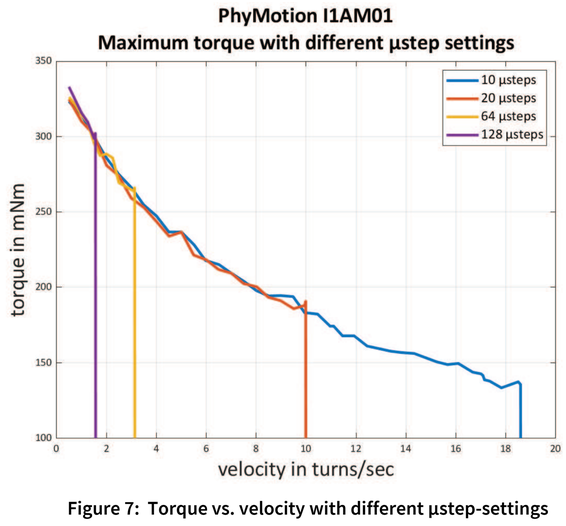

Figure 7: Torque vs. velocity with different µstep-settings

CONCLUSION

- Separate, beamline like test environment for motors and motion controllers
- Perform a variety of tests
- Easy switching between different motion controllers
- Collect information about specific motor-controller combinations
- Find suitable motor-controller combinations for specific tasks
- Validate performance of newly purchased motors and motion controllers

Outlook:
- Extend for snychronous driving
- Driving/Positioning with variable intertia

REFERENCES

[1]A.Hughes , B.Drury, 'Electric Motors and Drivers: Fundamentals, Types and Applications', Fifth Edition, Kidlington, United Kingdom, 2019, pp. 41-86

[2] R. Müller, J. Viefhaus, et al, “Modernization of experimental data taking at BESSY II”, doi:10.18429/JACoW-ICALEPCS2019-MOCPL02

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MORE INFORMATIONS

David Kraft, Maxim Brendike

david.kraft@helmholtz-berlin.de
maxim.brendike@helmholtz-berlin.de