

Advanced custom quasi direct drive Actuator Characterization & Production

Context:

The EPFL Xplore Research Pole has the objective of building a legged robot. The robot is designed to autonomously navigate through challenging terrain using its on-board sensors. Last semester, a second iteration of a high performance QDD actuator (1:6 reduction, 72 Nm, 1.5 kg, 30 rad/s) was developed, with a fully custom motor controller, frameless motor and double encoder system. As the system has been recently machined, rigorous testing and characterization have not yet been performed.

Project description:

The goal of this project is to validate the current design by conducting rigorous testing and characterization of the actuator (thermals, play, backlash, wear...). The student will gain invaluable hands-on experience working with cutting-edge robotic components, including state-of-the-art quasi-direct drive actuators, custom motor controllers, and precision encoder systems. This opportunity will provide deep insights into advanced actuator design, testing methodologies, and practical problem-solving in robotics.

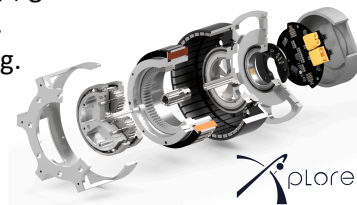
Furthermore, the student will be an integral part of the Xplore Legged Robot Team, actively participating in its weekly meetings and working sessions. This collaboration will facilitate close interaction with other team members, and the student is expected to share their findings and progress with the team regularly.

Tasks:

- **Literature Review and Familiarization** - Conduct a rapid literature review to understand the different parameters to characterize, how it is done and why they are important.
- **Coding** - Write custom Python test files to test the actuators in various but repeatable conditions.
- **Prototyping** - Prototype and assemble a test bench for the actuator.
- **Mechanical Design** - If needed, perform small adjustments to the mechanical design of the actuator from your findings and observations.
- **Manufacturing (optional)** - Ask for quotations to manufacturers, choose the best option. New Amulet BLDC controllers will also have to be assembled using the SPOT's pick&place machine.
- **Documentation** - Rigorous documentation is expected on the parameters tested, the test protocols used and the computations performed.

Requirements:

- Experience with CAD design, mastery of Fusion360 is a solid plus.
- BONUS: Exp. with mechanical assemblies, tolerances and components like bearings, gears...
- BONUS: Exp. with prototyping, machining techniques & manufacturer capabilities.
- Critical thinking, autonomy and initiative across mechanical design and prototyping.
- Basic Python Programming skills.
- Basic knowledge of Linux.



Contact:

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