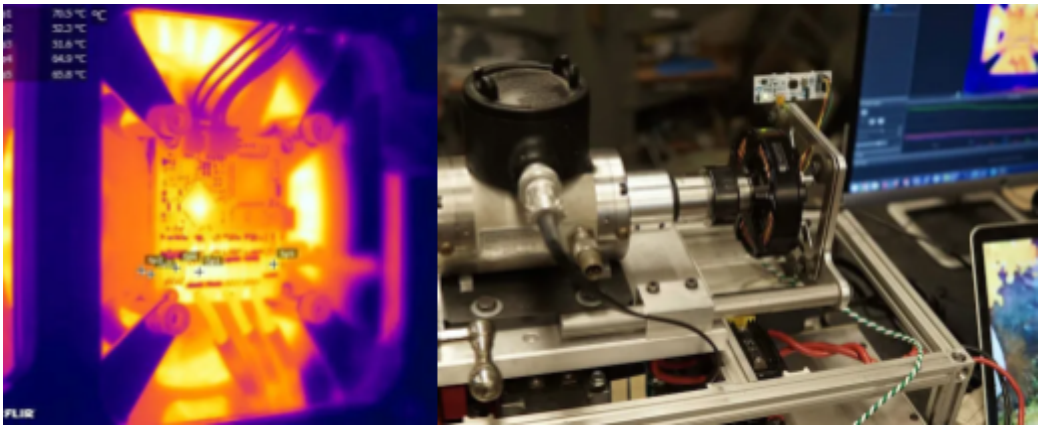
Application Deadline: September 10

Master Thesis / Forschungspraxis / Semesterarbeit

Developing Highly Dynamic Motion Capabilities for Custom PEA (Parallel Elastic Actuator) - Control & Prototyping



Picture source: Fixed Noise and Thermal Testing, Ben Katz, https://build-its-inprogress.blogspot.com/2018/07/fixed-noise-and-thermal-testing.html

Description

BLDC motors are growing in capabilities. They are an established choice for robotics solutions: from legged robots and beyond - even electric vehicles. While this motor technology has reached a level of maturity, the way it's integrated and the way its power is utilised can be quite different.

We are building on top of established robotics joints, such as the one used in the MIT Mini Cheetah [1], however, we are fully customizing its design with our own electronics, novel hardware aspects through integration of elastic elements and torque sensing.

We want to find a best way to exploit all novel actuator features in control. We have designed a first prototype and want to work on control implementation and testing through an adaptation for a highly dynamic use-case (e.g. vertical jumping or throwing).

Student work is planned to span prototyping for finalizing the test setup alongside robotics control concepts for exploitation of system elasticities. Promising research direction is emulating VSA behaviour [2] through the interaction of the mechanical spring and motor control.

We are looking for candidates with a strong interdisciplinary focus and interest in practical work, with an excellent academic record.

What you will gain:

- Experience in Modeling and Control of Robotics systems
- Experience building, prototyping
- Best design practices
- Insights into our System Development and access to our community

Requirements from candidates:

- Strong in **Control Methods**
- Any **CAD software** for the Part designs (such as Solidworks, Fusion 360,etc.)
- **Matlab** skills
- Basic skills in **Electronics**
- Plus are:
  - Understanding how **Motors** work
  - Familiarity with **GIT**
  - Working skills in **Ubuntu** operating system
  - **Embedded systems** development

To apply, you can send your CV, transcript and short motivation to Vasilije Rakcevic for initial review (application deadline - September 10).

Supervisors:

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References:

[1] P. M. Wensing, A. Wang, S. Seok, D. Otten, J. Lang and S. Kim, "Proprioceptive Actuator Design in the MIT Cheetah: Impact Mitigation and High-Bandwidth Physical Interaction for Dynamic Legged Robots," in IEEE Transactions on Robotics, vol. 33, no. 3, pp. 509-522, June 2017, doi: 10.1109/TRO.2016.2640183.
[2] Albu-Schäffer A, Wolf S, Eiberger O, Haddadin S, Petit F, Chalon M. “Dynamic modelling and control of variable stiffness actuators.” in 2010 IEEE International Conference on Robotics and Automation 2010 May 3 (pp. 2155-2162). IEEE.