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Actuator scaling law identification

Project type: BSc Thesis, Collaboration

Description

Scaling laws are pervasive in biological systems, found in a large number of life processes, and across 27 orders of magnitude. Recent findings show both biological and engineered motors adhering to two fundamental regimes for the mass scaling of maximum force output [1, 2]. This scaling law is of particular interest for the robotics field as it can affect the design stage of a robot. Findings imply that an upper motor limit of maximum specific torque/force could exist that should be taken under consideration in robot design, and that this limit is closely related to actuator load-life [3].

Tasks

You are to design and implement an experimental test-bed that will be used to test the hypothesis that the specific force output of a given actuator is closely related to its load-life. A number of actuators will also be provided for experimental testing. An existing test-bed will also be provided that you can improve upon.

Applicant

The applicant should be a mechanical engineering student/graduate, with a good background in mechanical design and CAD software (Solidworks preferred), with an interest in robotic/prosthetic applications. The thesis is to be written in English.

References

[1] J. H. Marden, Scaling of maximum net force output by motors used for locomotion., The Journal of experimental biology 208 (Pt 9) (2005) 1653–64.
[2] J. H. Marden, L. R. Allen, Molecules, muscles, and machines: universal performance characteristics of motors., Proceedings of the National Academy of Sciences of the United States of America 99 (7) (2002) 4161–6.
[3] Konstantinos Dermitzakis, Juan Pablo Carbajal and James H. Marden, Scaling Laws in Robotics., The European Future Technologies Conference and Exhibition (FET '11). Budapest, Hungary, May 2011.

Supervisor

Your contact for this project is Konstantinos Dermitzakis from the AI Lab Zurich (http://ailab.ch/dermitza). You can best reach him by email (dermitza@ifi.uzh.ch).