

## Master project: Adaptive legged robot

At the ROBIN research group artificial evolution is currently used for optimizing both robotic gaits and robotic morphology (shape).

**Hypothesis:** *Physical adaptation of geometrical parameters such as leg lengths during the learning process is expected to increase the performance*

The term performance can be discussed/defined by the student. No such robots are currently available in this framework. In this master project the student will investigate this hypothesis by building a physical adaptive robot and running either an evolutionary gait optimization or a local search based gait optimization process on it. A first (probably non-working) sketch/version of an adaptive legged robot will be available as a SolidWorks CAD model.



### Plan for the project:

- 1) Literature search
  - 2) Writing of essay. This can be considered to be the introduction and a coarse background of the master thesis.
  - 3) Investigating the provided first CAD version/sketch and deciding if it is to be 3D printed directly or with modifications
  - 4) Several CAD / 3D printed (or laser cutted) versions of the robot must be made and evaluated
  - 5) Programming of test gaits / test adaptations (for example in Java/Processing or C++)
  - 6) Interfacing the program to the 3D motion tracker system for measuring the gait performance (fitness function)
  - 7) Evolutionary or local search experiments by either
    - a) Running local search (hill climbing) combined with a fixed gait on the physical robot as a step in verifying the hypothesis
    - b) Running the ROBIN evolutionary framework directly on the robot to verify the hypothesis
  - 8) Conclusions
- 1-8) Writing of the thesis should be done continuously during the project

### Hardware:

- \* Dynamixel servos
- \* Stepper motor or geared DC motor or complete linear motor system
- \* 3D printer / laser cutter
- \* 3D motion tracker system
- \* Other hardware/electronics may be used if necessary