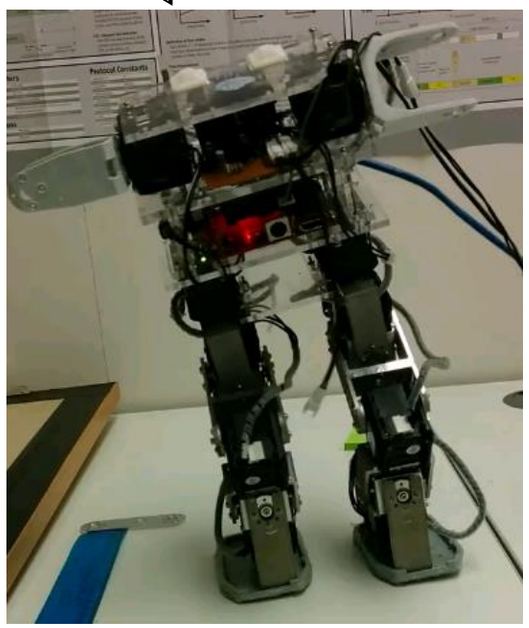
Investigation of an Improved Method of Gait for the Panther Robot

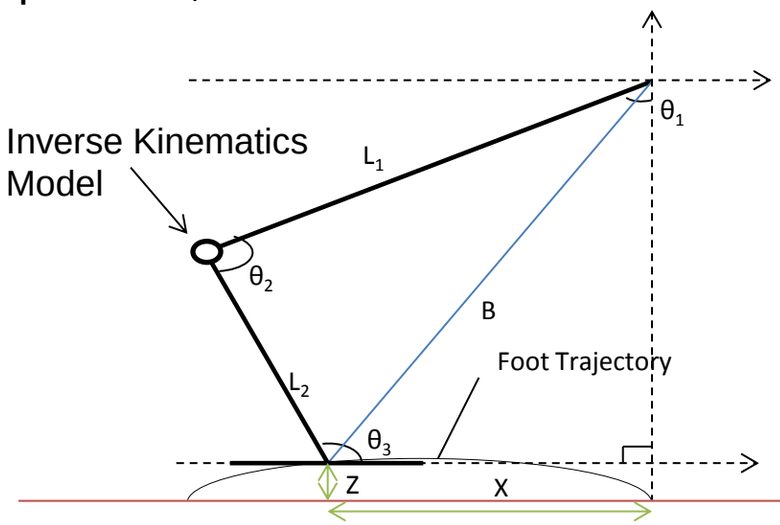
Alex Dotsch, Individual Research Project 2013-14

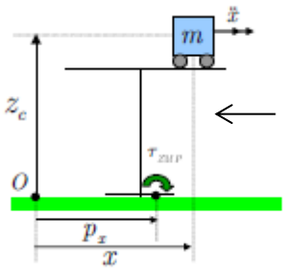
Introduction

The project aim was to find the best possible configuration of gait (body offset, torso tilt and stride length) and system parameters in order to have the least compromising stability, speed and energy efficiency, with stability as the dominating variable to be optimised, for the PANTHER robot.

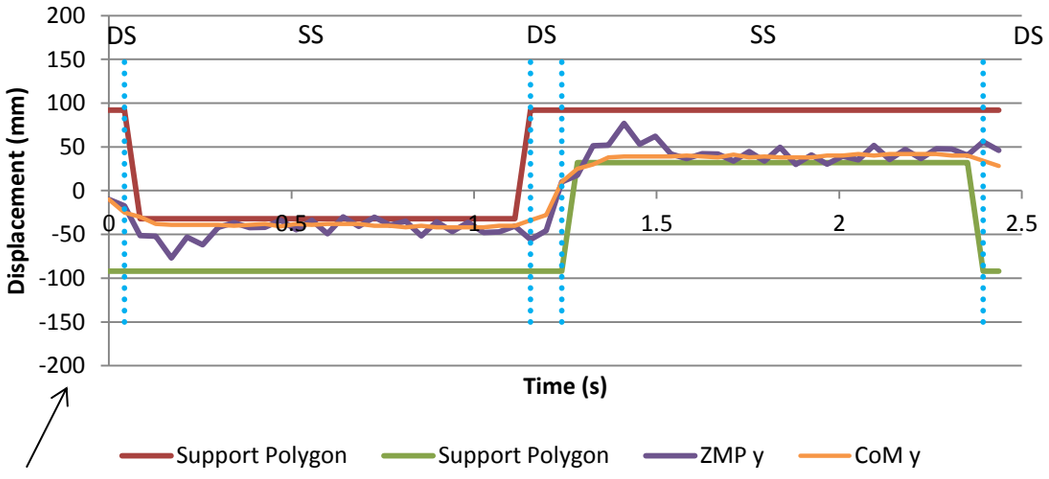
The PANTHER Robot







Cart Table Model



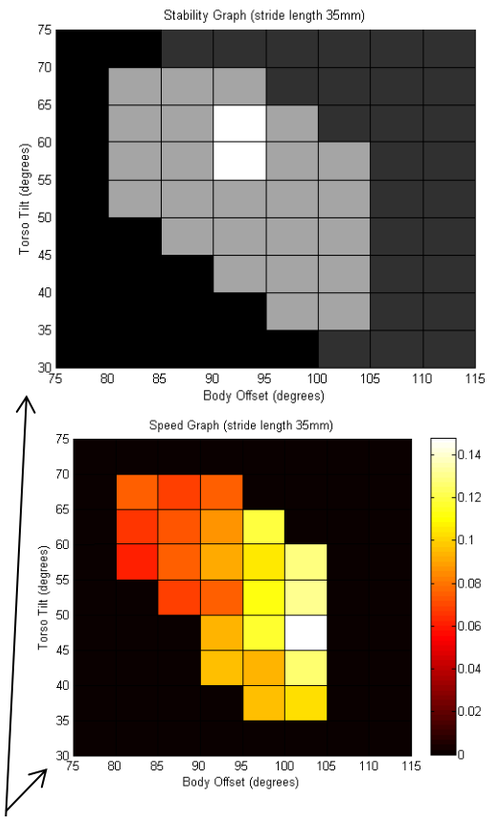
ZMP in y-direction results

Method

- An inverse kinematics program was built in C++
- Stability was analysed both empirically, through a walking experiment with multiple combinations of parameters, and theoretically, by calculating the position of the Zero Moment Point, using the Cart Table model, by hand for samples of the gait.
- Speed was analysed physically, through the same walking experiment as stability, and electronically, by finding the fastest possible programming loops in the control systems and communication settings between control systems.
- Energy consumption was measured experimentally, using an optimised gait found from the stability and speed experiments, and then compared to human gait.

Results and Conclusions

The most stable gaits were found when torso tilt had a moderate value, body offset had a moderately high value and stride length had a low value. The fastest gaits were found when torso tilt had a moderate value, body offset had a very high value and stride length had a high value. The energy consumption of the gait was found to be far higher than humans, but this was to be expected due to the inefficient robot design.



Stability and Speed experiments results

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