

# PhD meeting

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# Outline

- ① Summary of work
- ② Work on max-plus gait generation
- ③ Goals of the paper
- ④ A few announcements

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## Summary of work

- Worked on implementation of max-plus in framework
- Studied feedback linearization of Thiago Boaventura
- Started convex optimization study group
- Had a meeting to define goals towards paper

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# Work on max-plus gait generation

- Current state: The gazebo simulation works the same as in the simulation in python that I previously had
- Further features:
  - Instantaneous (1 step) gait parameter change
  - Problems with touchdown and lift-off event detection
  - Angular frequency modulation
  - Try a different trajectory generator

## "Instantaneous" gait change

- Detect legs in swing face
- Use them as the "follow-up" legs for the next gait pattern  
Example: If the current gait is:

$$G_1 = \{1, 4\} \prec \{2, 3\}$$

And we desire to change to:

$$G_2 = \{1\} \prec \{2\} \prec \{3\} \prec \{4\}$$

In the case that legs 2 and 3 are in the air, the gait transition patterns could be chosen as:

$$G_2^* = \{2\} \prec \{3\} \prec \{1\} \prec \{4\}$$

$$G_2^{**} = \{3\} \prec \{4\} \prec \{1\} \prec \{2\}$$

- The transition would be safe, would be made during the step that the robot is taking and with a finite number of gait transition patterns

# Evaluation of viability of max-plus generation

- Run comparison against current method
  - Gait switch
  - Versatility of gait generation
  - Difficulty to be implemented and controlled
  - Flexibility to be included in the framework
- Analyze pros and cons between the two approaches
- (Propose new approach)



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## Goals of the paper

- Overcome terrain variations (such as a ramp) based on timed-event feedback
- Come up with a methodology to decide and implement in a systematic way, a set of gait parameters to overcome certain types of terrain (e.g., stair climbing)

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# Announcements

- Machine Learning Crash Course will start 26/06
- BMVA Computer Vision Summer school starts 03/07 (have to pay for myself and reimbursed afterwards, since it can only be paid by credit or debit card)

## Summer School on Foundations of Robotics and Autonomous Learning

- Dates: 04/09 - 08/09 (close to ICRA deadline)
- Location: Berlin
- Topics:
  - Robotics: with a focus on foundations and a unifying perspective of the involved fields Basics of control, manipulation, planning
  - Machine Learning: with a focus on Autonomous Learning: the interaction of decision theory and learning Basics of Decision Theory, Active Learning, Bayesian Experimental Design, Reinforcement Learning, Adaptive Control, Inverse RL, Machine Learning applied to Robotics
- Lecturers: Michael Beetz (Bremen University), Oliver Brock (TU Berlin), Sami Haddadin (Hannover University), Tamim Asfour (KIT), Ludovic Righetti (Max-Planck Institute for Intelligent Systems), Marc Toussaint (University of Stuttgart)

Thank you. Questions or comments?