Kick-off “Projektwettbewerb Konzepte der Regelungstechnik”

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Institute for Systems Theory and Automatic Control
University of Stuttgart

May 07th, 2018

Significance

P-KRT. Within the "Praktikum KRT", you were asked to design a controller meeting predefined requirements (control objectives) **under scientific supervision** (TA). In doing so, the controller design procedure was **a priori structured** into work packages corresponding to the approach of S. Skogestad.

PW-KRT. Within the "Projektwettbewerb KRT", you are asked to design a controller meeting predefined requirements (control objectives) **without scientific supervision**. In doing so, **you have to structure** the controller design procedure into work packages, e.g. corresponding to the approach of S. Skogestad.

Challenge.

You will have to **organize this project** over the entire semester!

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May 7th	Kick-off
May 8th	C@MPUS Registration closes
May 9th - May 31st	Exam Registration*
↑	
PW-KRT	self-organization
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June 17th	submission due
↕	evaluation
July 2rd	closing discussion

Self-Organization.

Organizing yourselves does not mean that you are on your own. In fact, **I encourage you to contact me** when you have questions!

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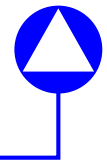

Applicability. We want you to work on a model-based controller design that applies to a problem of **practical relevance**, that is based on **a model that is used in industry**, and which has **intuitive performance criteria**.

- **Practical Relevance.** Vehicle Dynamics!
- **A Model that is Used in Industry.** Single-Track Model!
- **Intuitive Performance Criteria.** Lap Time!

Project Goal.

Design a **state-feedback controller** for the single-track model that steers it **along a racetrack**!

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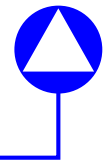

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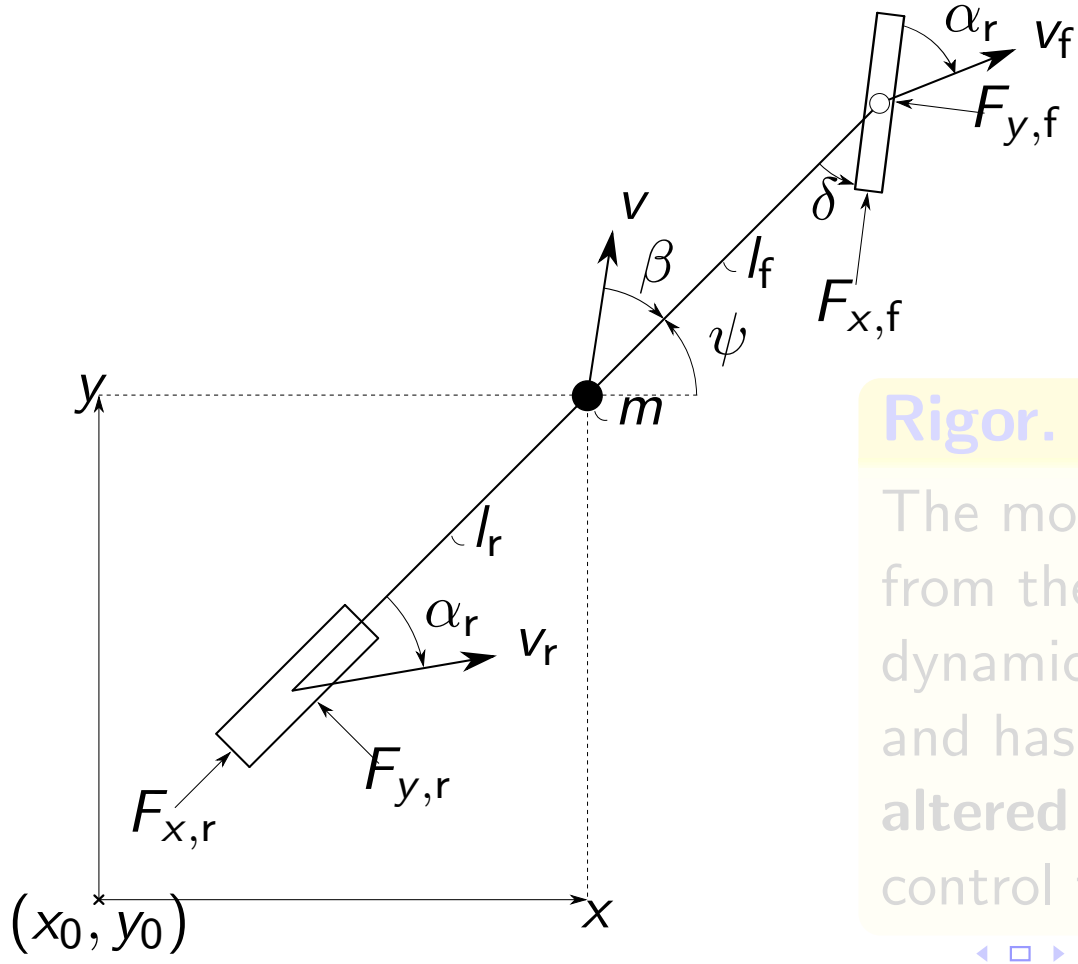
Controls. steering, gear, breaking force (& distribution), pedal



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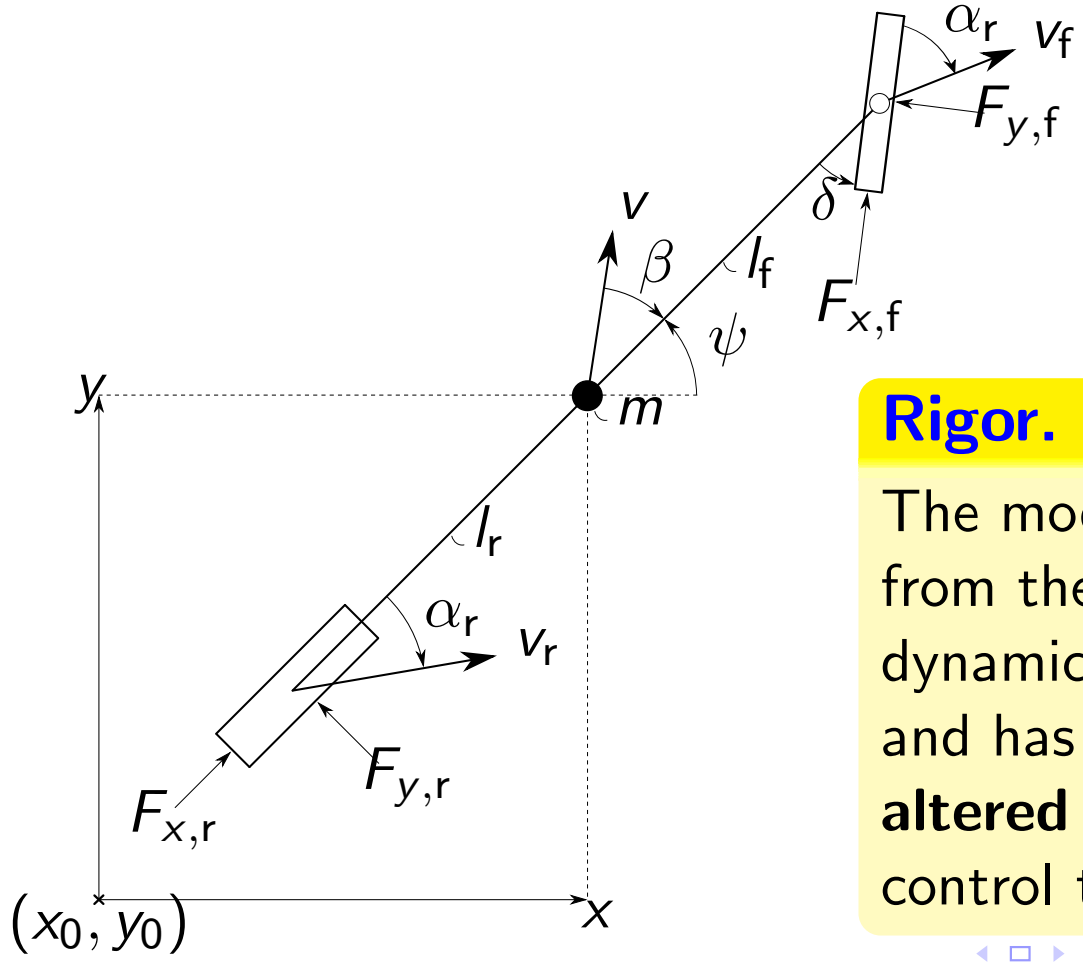

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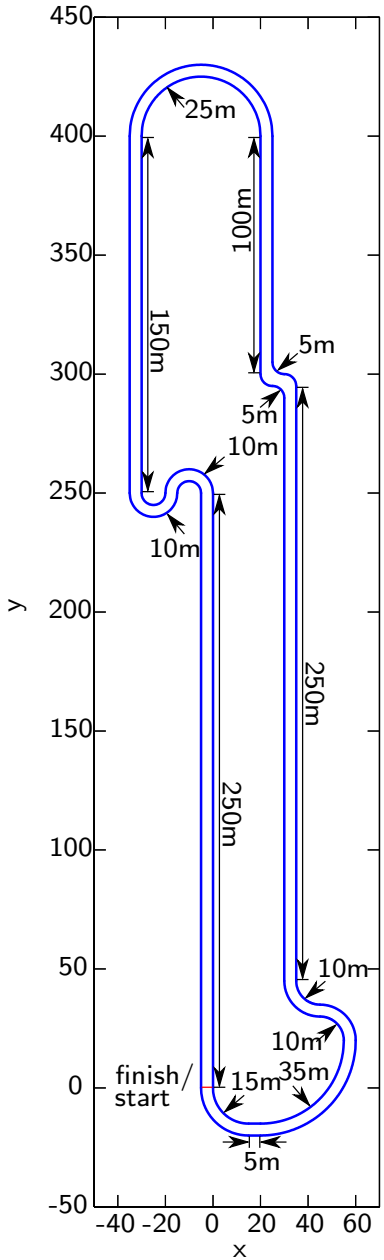

Goal. Assign to every vector of states x a vector of controls u that lets the single-track model drive on the depicted **racetrack**, i.e. find a function $K : x \mapsto u$: a **state feedback controller**!

Full Measurements.

You do not have to take into account an **output** $x \mapsto y$ (i.e. you do not have to design an observer) and you have knowledge of the **complete racetrack coordinates** at all times (which is required for **lane keeping**)!

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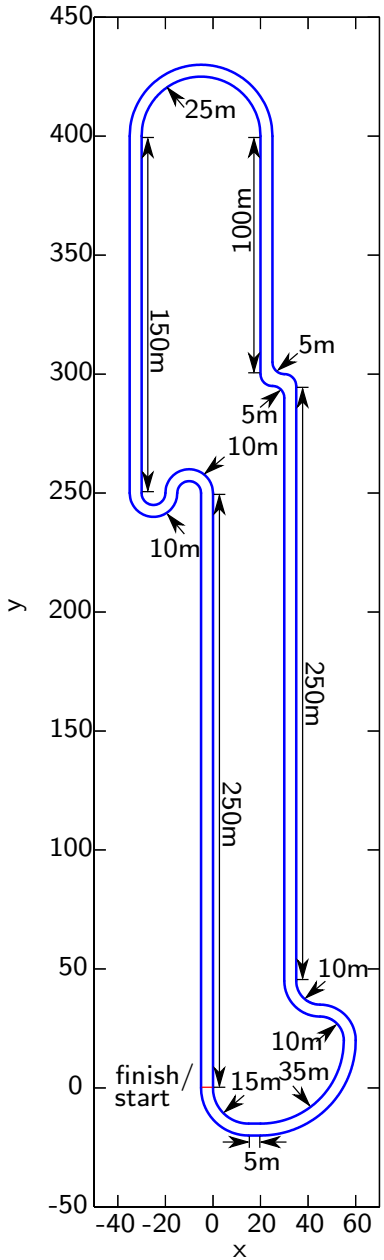

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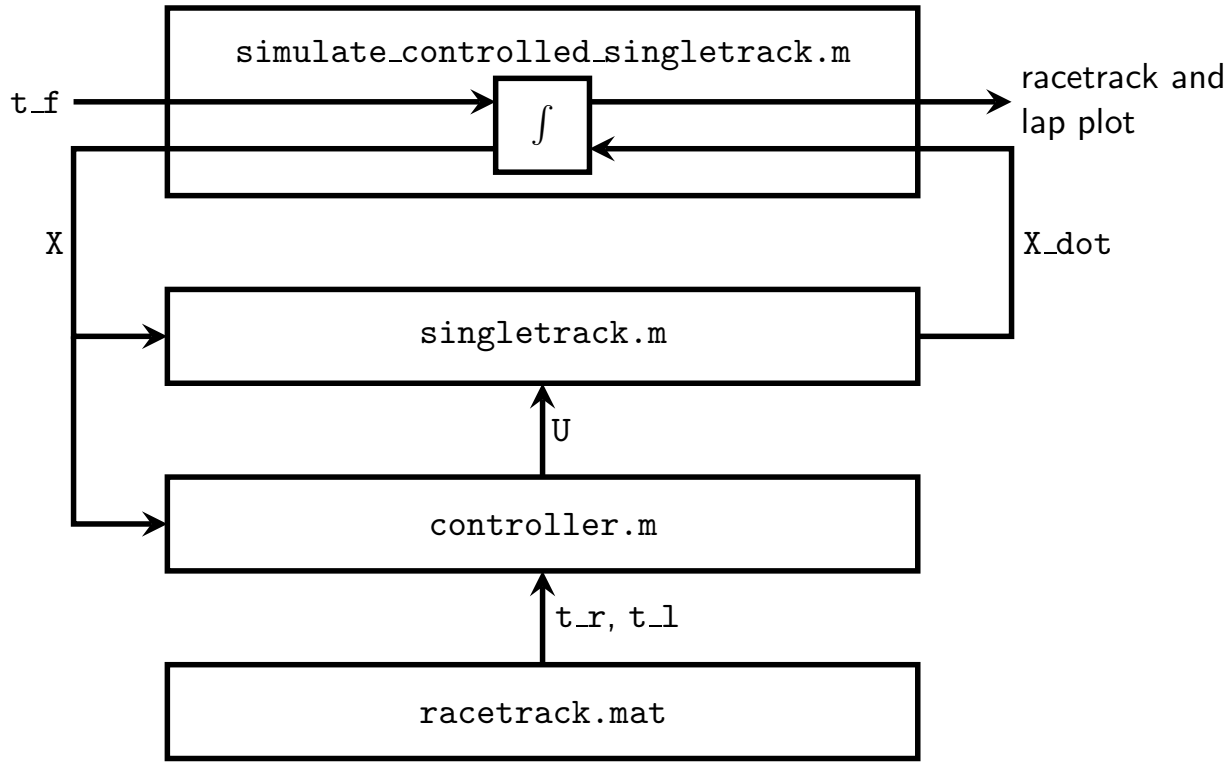

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You must deliver the `*.m` file containing K plus the simulation time `t_f` that you need to complete the racetrack!

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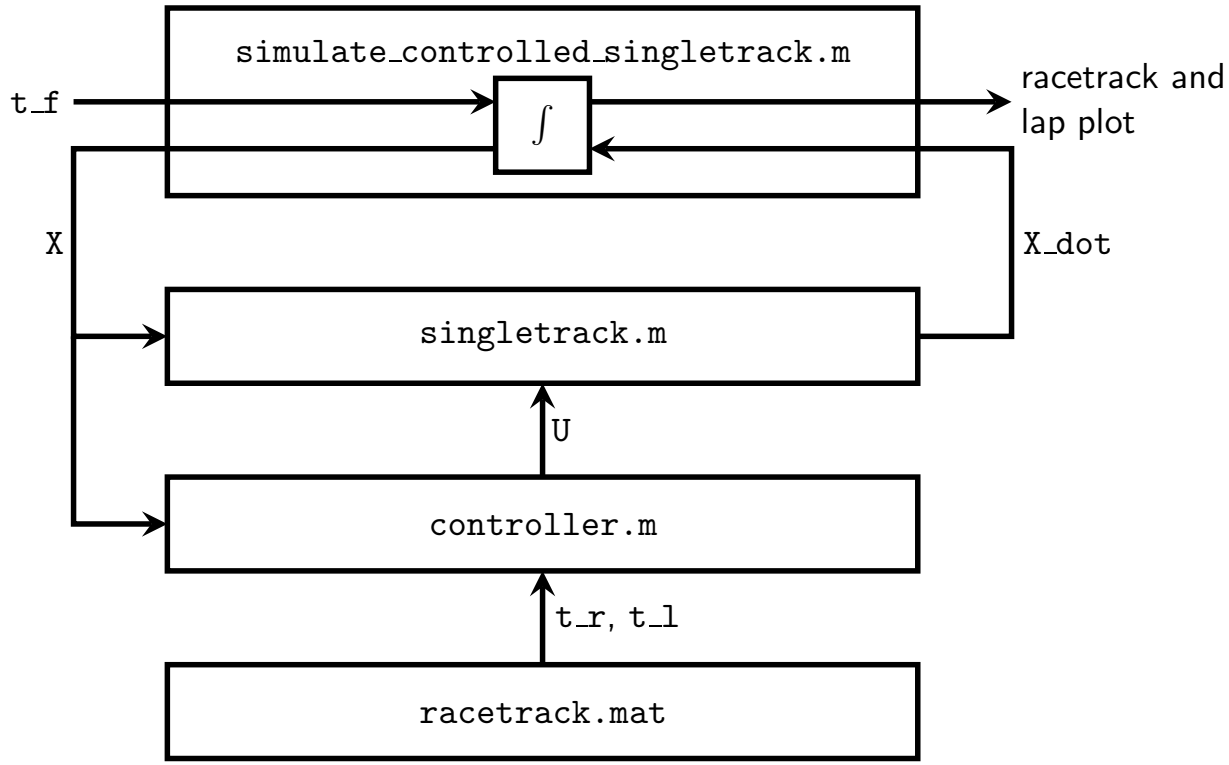

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Competition. A **necessary condition** to pass the course is to deliver a controller that lets the single-track model complete one lap of the racetrack. The team which delivers the **lowest value** for `t_f` among all participants **wins the contest**!

Deliverables (cont'd). You must submit the controller K, the lap time `t_f`, and a **very brief** LaTeX document explaining how you derived your control law! (can be in German or English)

Resources. Most information is on the course website `http://www.ist.uni-stuttgart.de/lehre/lehrveranstaltungen/ss2018/PW_KRT` and all material can be found on ILIAS as soon as the contest starts!

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As always we are looking forward to your feedback. Please **do not hesitate to suggest improvements or changes**!

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Organization

Teams

- Register in ILIAS
- Name your team-mate of choice (pair up in teams of two)
- If you don't name a team-mate, you will be assigned a partner. In this case, please contact your partner as soon as possible. If you don't get any response, please contact me to find a solution.

Delivery

- Upload on ILIAS
- Upload your report.pdf (or similar) and the controller.m
- Indicate clearly what is your submission and what are working files/folders
- The time and date of your submission will be checked

Summary

- This PW-KRT is organized by you!
- Contact me with questions, suggestions, or critique!
- Develop a state feedback K for the single-track model!
- The control objective is to complete one lap on a racetrack!
- You may access the state of the vehicle and all racetrack data!
- You must submit the `*.m` file containing K, the simulation time `t_f`, as well as a very brief LaTeX document explaining how you derived your control law!
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The End.

Do you have any questions?

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