

# Patrick Scheffe, M.Sc. RWTH

Member of the [Cyber-physical Mobility Group](#)

## Contact



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## Research

My research focus lies on networked control systems in the context of the [GROKO-Plan](#) project. New approaches in networked control can be evaluated in the [CPM Lab](#) experimentally. The [videos on YouTube](#) give an impression of the CPM Lab and research done by members of the [CPM Group](#).

## Theses

Open topics in my [research area](#) usually exist. If you are interested in my research, we can meet up or you can contact me via email in order to draft a suitable thesis topic.

Students worked on the following topics under my supervision:

- Analysis of existing autonomous and networked model-scale vehicles
- Combining graphs for maneuver-based motion planning of networked vehicles
- Sensor fusion for indoor position estimation of model-scale vehicles
- Path tracking control of model-scale vehicles
  - Distributed trajectory planning for networked vehicles using graphs
  - Receding horizon control using graph search for networked vehicle trajectory planning
- Priority assignment in graph-based distributed trajectory planning

- Using dynamic priority assignment to increase feasibility in priority-based networked control
  - Dynamic priorities to increase feasibility in graph-based trajectory planning for networked model-scale vehicles
- Parallel Priority-based Trajectory Planning with Safety Guarantees for Networked Vehicles
  - Implementation of a Manual Controller for Model-scale Vehicles in Mixed Traffic
  - Computationally Efficient Graph-based Motion Planning of Networked Vehicles
- Computationally Efficient Graph Search Algorithms for Experiments of Distributed Trajectory Planning
- Generalizing Model-Scale Experiments in Networked and Autonomous Driving Using a Service-Oriented Architecture
- Centralized Graph-Search Algorithms for Effective Trajectory Planning of Networked Vehicles

## Teaching

Semester	Title	Style
22 Winter	<a href="#">Regelung und Wahrnehmung in vernetzten und autonomen Fahrzeugen</a>	Lecture + Lab
21 Winter	<a href="#">Regelung und Wahrnehmung in vernetzten und autonomen Fahrzeugen</a>	Lecture + Lab
20 Winter	<a href="#">Regelung und Wahrnehmung in vernetzten und automatisierten Fahrzeugen</a>	Lecture + Lab
19 Winter	<a href="#">Regelung und Wahrnehmung in vernetzten und automatisierten Fahrzeugen</a>	Lecture + Lab

## Publications

[KSA23]

[PDF](#)[BIB](#)

Kloock, M. M., Scheffe, P., and Alrifaae, B., "Testing distributed trajectory planning in the cyber-physical mobility lab", *Automatisierungstechnik*, vol. 71, iss. 4, pp. 317-325, 2023

## Testing distributed trajectory planning in the cyber-physical mobility lab

### Bibtex entry :

```
@article { KSA23,  
  author = { Kloock, Maximilian Martin and Scheffe, Patrick and  
Alrifaae,  
  Bassam },  
  title = { Testing distributed trajectory planning in the  
cyber-physical mobility lab },  
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http://publications.rwth-aachen.de/record/955879/files/955879.pdf },
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[KSG+23]

[PDFBIB](#)

Kloock, M. M., Scheffe, P., Gress, O., and Alrifaae, B., "An Architecture for Experiments in Connected and Automated Vehicles", *IEEE open journal of intelligent transportation systems*, vol. 4, pp. 175-186, 2023

## An Architecture for Experiments in Connected and Automated Vehicles

### Bibtex entry :

```
@article { KSG+23,
  author = { Kloock, Maximilian Martin and Scheffe, Patrick and
Gress,
  Ole and Alrifaae, Bassam },
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[PSA+23]

[PDFBIB](#)

Pedrosa, M. V. A., Scheffe, P., Alrifaae, B., and Flaßkamp, K., "Optimization-based motion primitive automata for autonomous driving", *Automatisierungstechnik : AT*, vol. 71, iss. 4, pp. 294-300, 2023

# Optimization-based motion primitive automata for autonomous driving

## Bibtex entry :

```
@article { PSA+23,  
  author = { Pedrosa, Matheus V. A. and Scheffe, Patrick and  
Alrifaae,  
    Bassam and Fla{\ss}kamp, Kathrin },  
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[SA23]

[PDFBIB](#)

Scheffe, P. and Alrifaae, B., "A Scaled Experiment Platform to Study Interactions Between Humans and CAVs", in *Proc. IEEE IV 2023 : IEEE Intelligent Vehicles Symposium : Anchorage, Alaska, USA, June 4-7, 2023 / sponsors and organizers: IEEE, IEEE Intelligent Transportation Systems Society*, Piscataway, NJ, 2023, IEEE, p. 6.

## A Scaled Experiment Platform to Study Interactions Between Humans and CAVs

## Bibtex entry :

```
@inproceedings { SA23,  
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  title = { A Scaled Experiment Platform to Study Interactions  
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[SAK23]

[PDFBIB](#)

Scheffe, P., Alrifaae, B., and Kowalewski, S., "Networked Model Predictive Control for Multi-Vehicle Decision-Making", in *Proc. [57. Regelungstechnisches Kolloquium, 2023-02-22 - 2023-02-24, Boppard, Germany]*, 2023.

## Networked Model Predictive Control for Multi-Vehicle Decision-Making

### Bibtex entry :

```

@inproceedings { SAK23,
  author = { Scheffe, Patrick and Alrifaae, Bassam and Kowalewski,
Stefan },
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```

[SHK+23]

[PDFBIB](#)

Scheffe, P., Henneken, T. M., Kloock, M. M., and Alrifaae, B., "Sequential Convex Programming Methods for Real-time Optimal Trajectory Planning in Autonomous Vehicle Racing", *IEEE Transactions on Intelligent Vehicles : T-IV*, vol. 8, iss. 1, pp. 661-672, 2023

## Sequential Convex Programming Methods for Real-time Optimal Trajectory Planning in Autonomous Vehicle Racing

### Bibtex entry :

```
@article { SHK+23,  
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[MSK+22]

[PDFBIB](#)

Mokhtarian, A., Scheffe, P., Kowalewski, S., and Alrifaae, B., "Remote Teaching with the Cyber-Physical Mobility Lab", *IFAC-PapersOnLine*, vol. 55, iss. 17, pp. 386-391, 2022

## Remote Teaching with the Cyber-Physical Mobility Lab

### Bibtex entry :

```
@article { MSK+22,  
  author = { Mokhtarian, Armin and Scheffe, Patrick and Kowalewski,  
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```

[SDA22]

PDFBIB

Scheffe, P., Dorndorf, G., and Alrifaae, B., "Increasing Feasibility with Dynamic Priority Assignment in Distributed Trajectory Planning for Road Vehicles", in *Proc. 2022 IEEE 25th International Conference on Intelligent Transportation Systems (ITSC) : 8-12 Oct. 2022*, Piscataway, NJ, 2022, IEEE, pp. 3873-3879.

## Increasing Feasibility with Dynamic Priority Assignment in Distributed Trajectory Planning for Road Vehicles

### Bibtex entry :

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@inproceedings { SDA22,
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[SPF+22]

## PDFBIB

Scheffe, P., Pedrosa, M. V. A., Flaßkamp, K., and Alrifaae, B., "Receding Horizon Control Using Graph Search for Multi-Agent Trajectory Planning", *IEEE Transactions on Control Systems Technology*, vol. 31, iss. 3, pp. 1092-1105, 2022

# Receding Horizon Control Using Graph Search for Multi-Agent Trajectory Planning

## Bibtex entry :

```
@article { SPF+22,  
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[KSM+21]

## PDFBIB

Kloock, M. M., Scheffe, P., Maczijewski, J., Kampmann, A., Mokhtarian, A., Kowalewski, S., and Alrifaae, B., "Cyber-Physical Mobility Lab : An Open-Source Platform for Networked and Autonomous Vehicles", in *Proc. 2021 European Control Conference (ECC)*, [Piscataway, NJ], 2021, IEEE, pp. 1937-1944.

# Cyber-Physical Mobility Lab : An Open-Source Platform for Networked and Autonomous Vehicles

## Bibtex entry :

```
@inproceedings { KSM+21,  
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```

[KST+20]

[PDFBIB](#)

Kloock, M. M., Scheffe, P., Tülleners, I., Maczjewski, J., Kowalewski, S., and Alrifaaee, B., "Vision-Based Real-Time Indoor Positioning System for Multiple Vehicles", *IFAC-PapersOnLine*, vol. 53, iss. 2, pp. 15446-15453, 2020

## Vision-Based Real-Time Indoor Positioning System for Multiple Vehicles

### Bibtex entry :

```

@article { KST+20,
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[SMK+20]

[PDFBIB](#)

Scheffe, P., Maczijewski, J., Kloock, M. M., Kampmann, A., Derks, A., Kowalewski, S., and Alrifaae, B., "Networked and Autonomous Model-scale Vehicles for Experiments in Research and Education", *IFAC-PapersOnLine*, vol. 53, iss. 2, pp. 17332-17337, 2020

## Networked and Autonomous Model-scale Vehicles for Experiments in Research and Education

**Bibtex entry :**

```
@article { SMK+20,  
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[KSB+19]

[PDFBIB](#)

Kloock, M. M., Scheffe, P., Botz, L., Maczijewski, J., Alrifaae, B., and Kowalewski, S., "Networked Model Predictive Vehicle Race Control", in *Proc. The 2019 IEEE Intelligent Transportation Systems Conference - ITSC : Auckland, New Zealand, 27-30 October 2019 / IEEE, IEEE-ITSC 2019, ITSS - IEEE Intelligent Transportation Systems Society, Piscataway, NJ, 2019, IEEE*, pp. 1552-1557.

## Networked Model Predictive Vehicle Race Control

**Bibtex entry :**

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@inproceedings { KSB+19,  
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[KSM+19]

[PDFBIB](#)

Kloock, M. M., Scheffe, P., Marquardt, S., Maczijewski, J., Alrifaae, B., and Kowalewski, S., "Distributed Model Predictive Intersection Control of Multiple Vehicles", in *Proc. The 2019 IEEE Intelligent Transportation Systems Conference - ITSC : Auckland, New Zealand, 27-30 October 2019 / IEEE, IEEE-ITSC 2019, ITSS - IEEE Intelligent Transportation Systems Society*, Piscataway, NJ, 2019, IEEE, p. 8917117, 1735-1740.

## Distributed Model Predictive Intersection Control of Multiple Vehicles

### Bibtex entry :

```

@inproceedings { KSM+19,
    author = { Kloock, Maximilian Martin and Scheffe, Patrick and
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