TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

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Chair of Traffic Process Automation,
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Decentralized Truck Platooning Coordination

& an introduction to the Chair of Traffic Process Automation

59. Regelungstechnisches Kolloquium in Boppard
Boppard, 28-03-2025

Professur für **Verkehrsprozess-automatisierung**

Chair of Traffic Process Automation

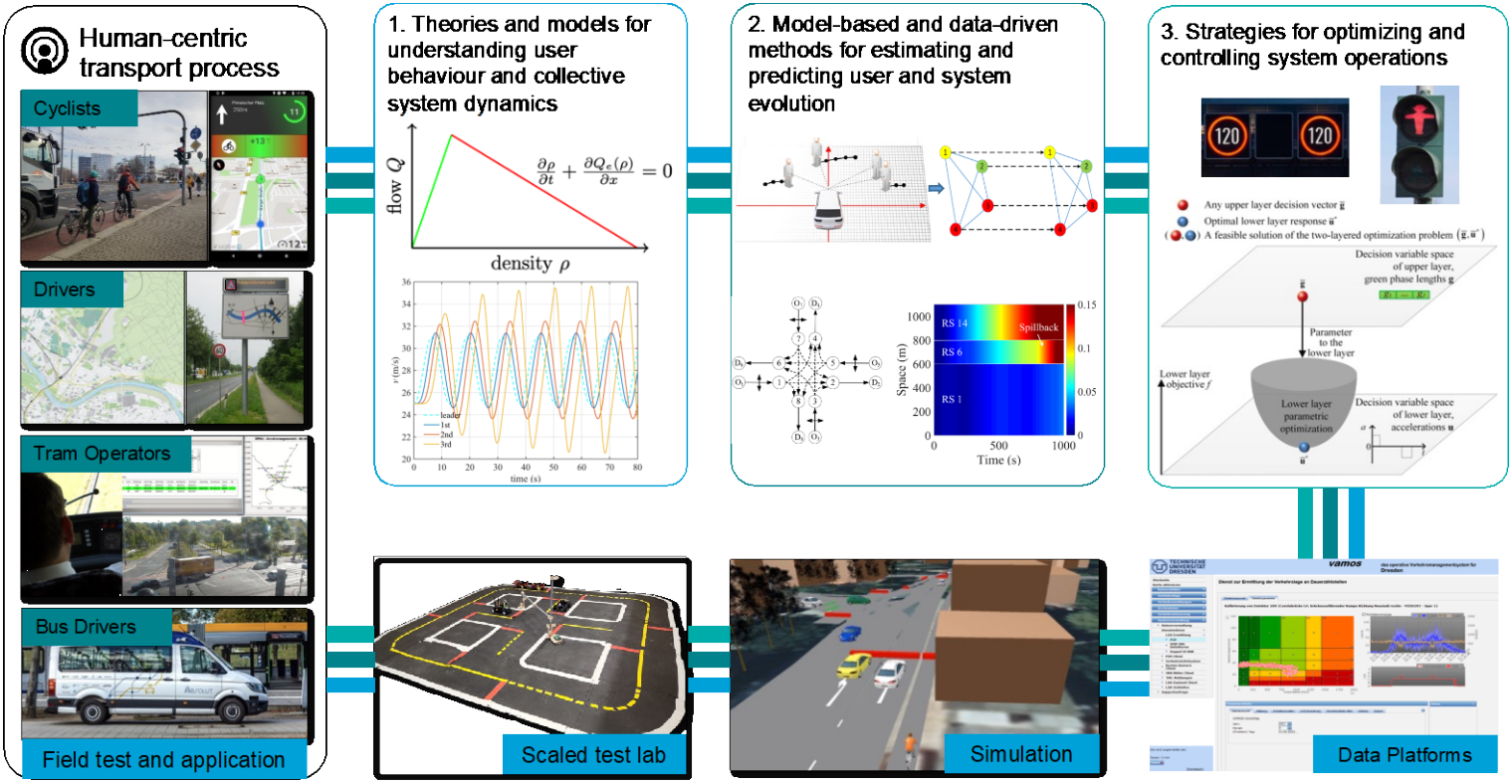
One of the **23** Transportation Chairs in the Faculty of Transport and Traffic Sciences @TU Dresden

Goal: Tackle transport challenges by leveraging communication and automation to **optimize and control** the operations of **multimodal** transport systems for **safety, efficiency and sustainability**.

Thematic area:

1. Traffic flow modelling and simulation
2. Multimodal traffic management
3. Connected and automated vehicles
4. Behaviour and services of vulnerable road users

Human-Centric (Closed-Loop) Systems Approach



4. Procedures, metrics and tooling for testing system performance and assessing macroscopic impact

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Yikai Zeng, Raj T. Rajan and ,Meng Wang

Decentralized coordination for truck platooning

Zeng, Y., Wang, M., & Rajan, R. T. (2022). Decentralized coordination for truck platooning. *Computer-Aided Civil and Infrastructure Engineering*, *37*(15), 1997-2015.

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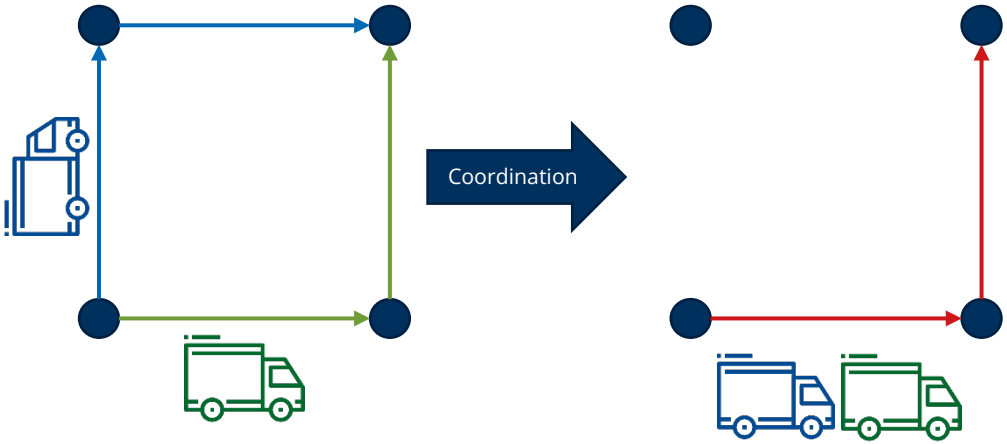
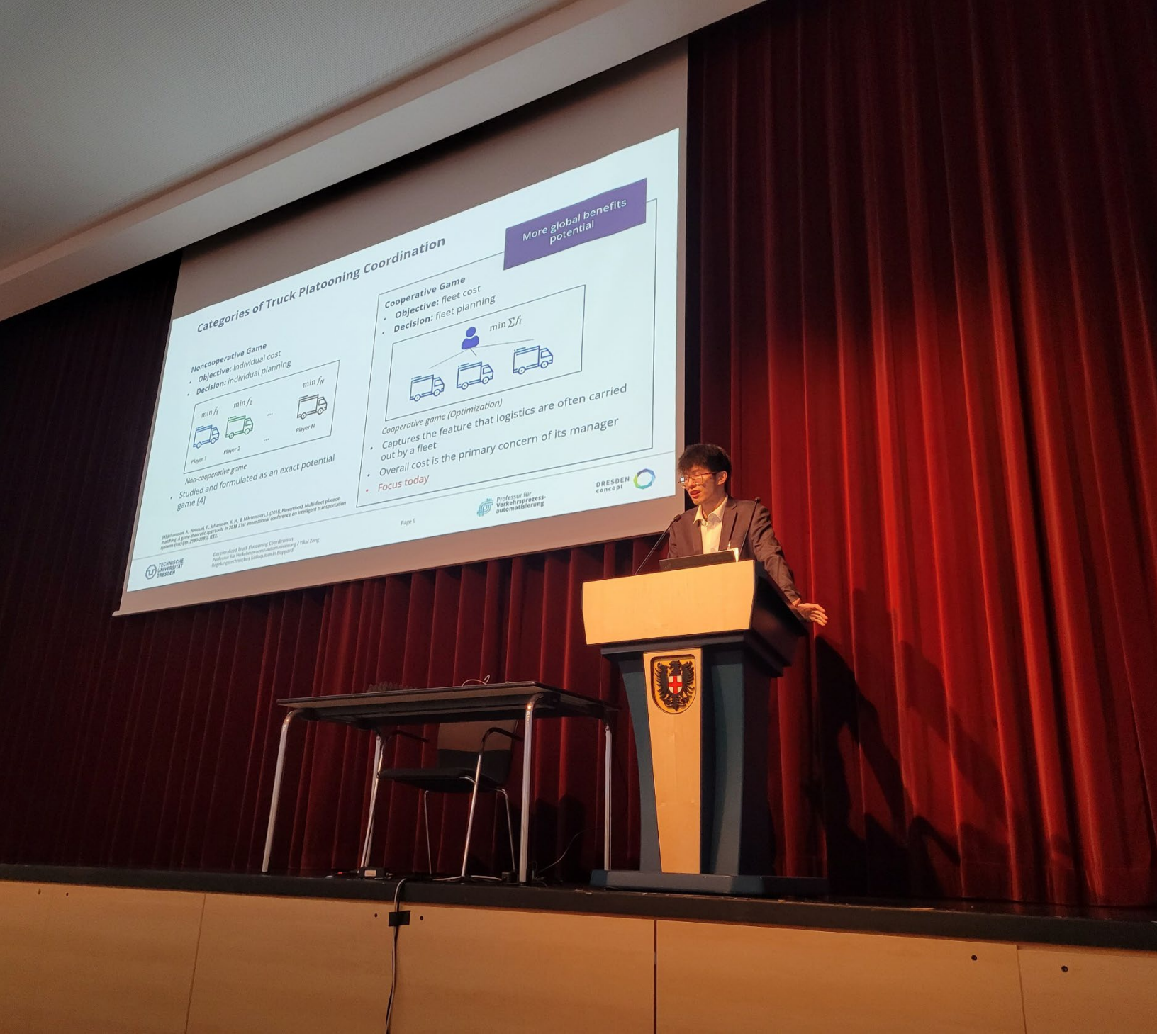
Truck Platooning and its High-level Coordination

- Truck platooning : the active formation of a group of autonomous trucks traveling at close spacing
- Road tests reveal that a 13% of energy saving at a 10m gap and a 18% saving at a 4.7 m gap [1]
- Opportunistic platooning [3]: **Match by chance**
- Probability is low in ad-hoc network
- Actively seeking more chances: **high-level coordination of truck platooning [2]**



[1] Tsugawa, S. (2014, June). Results and issues of an automated truck platoon within the energy ITS project. In *2014 IEEE Intelligent Vehicles Symposium Proceedings* (pp. 642-647). IEEE.
[2] Johansson, A., Bai, T., Johansson, K. H., & Mårtensson, J. (2022). Platoon Cooperation Across Carriers: From System Architecture to Coordination. IEEE Intelligent Transportation Systems Magazine.
[3] Bhoopalam, A. K., Agatz, N., & Zuidwijk, R. (2018). Planning of truck platoons: A literature review and directions for future research. *Transportation research part B: methodological*, *107*, 212-228.


Categories of Truck Platooning Coordination
More global benefits potential
Noncooperative Game
Objective: individual cost
Decision: individual planning
min f1
min f2
min fN
Player 1
Player 2
Player N
Non-cooperative game
Studied and formulated as an exact potential game [4]
Cooperative Game
Objective: fleet cost
Decision: fleet planning
min Σfi
Cooperative game (Optimization)
Captures the feature that logistics are often carried out by a fleet
Overall cost is the primary concern of its manager
Focus today
Page 6
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