



## Microscopic Modelling and Simulation

### Basic information

Master:	Verkehrswirtschaftsingenieurwesen	Bauingenieurwesen
Mandatory/optional:	Mandatory	Optional
Workload:	6 LP / 180 hours	3 LP / 90 hours
Requirements	Written exam (60 min, 4 LP) Homework (without grade)	Written exam (60 min, 3 LP)
Duration of module:	1 Semester	
Recommended semester:	2 <sup>nd</sup> Semester	
Frequency:	Every second semester (summer semester)	
Can be repeated:	Twice (exam)	
Components	<ul style="list-style-type: none"> <li>• Fundamentals of microscopic modeling and simulation of traffic</li> <li>• Types of models</li> <li>• Stochastic</li> <li>• Measures of error</li> </ul>	

### Instructors

Lectures: Univ.-Prof. Dr.-Ing. Heather Kathis (Chair of Bicycle Traffic)

Appointments upon request per email  
Room: HD 34

Exercises: Daniel Muthmann from PTV

Student support: Danil Belikhov, research associate at the Chair of Bicycle Traffic  
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Room: HD 34

### Learning Objectives / Learning Outcomes - Overview

Content and Learning Objectives: Students will learn the fundamentals of microscopic traffic simulation and can create a model of a simple intersection using the simulation software PTV Vissim.

Lernergebnisse: Students will:

- Understand the concepts of model and simulation in general and in relation to transportation.
- Know the different scales of modeling and simulation (macroscopic, mesoscopic, and microscopic) and when each type of model should be used.
- Understand the types of field data required to create, calibrate, and validate a microscopic traffic simulation model.
- Be able to create a simple model using the microscopic simulation software PTV Vissim, including road network, traffic demand, and realistic behavior of road users.
- Understand the concepts of calibration and validation and apply simple approaches to both.



- Understand how to use a calibrated and validated simulation model to conduct a traffic study and calculate the number of required simulation runs.
- Familiarize themselves with the microscopic traffic simulation software Aimsun and SUMO.

## Moodle

All materials for the microscopic modeling and simulation course will be posted on Moodle. Moodle will also be used to communicate with students about anything that might come up in the semester.

## Important dates 2024

- First lecture: April 9<sup>th</sup>, 2024
- Last lecture: July 16<sup>th</sup>, 2024
- Homework due (VWing): July 31<sup>st</sup>, 2024
- Exam: TBD

Lectures will take place on Tuesdays from 10 am – 11:30 am in room HC.01.38.

## Software

The exercises of this course will be performed using the microscopic traffic simulation software PTV Vissim. Licenses are available to students to download on their personal computers. You will need to have PTV Vissim up and running on your laptop at the start of the exercise on April 16<sup>th</sup>. Information about the PTV Vissim licenses will be posted on Moodle.

## Schedule 2023

Date	What	Who
09.04.2024	Lecture 1: Introduction	Heather Kaths
16.04.2024	Exercise 1	Daniel Muthmann
23.04.2024	Lecture 2: Microscopic traffic simulation models	Heather Kaths
30.04.2024	Exercise 2	Daniel Muthmann
07.05.2024	Lecture 3: Simulation experiments and data	Heather Kaths
14.05.2024	Exercise 3	Daniel Muthmann
28.05.2024	Lecture 4: Simulating intersections / intro to homework	Heather Kaths
04.06.2024	Exercise 4	Daniel Muthmann
11.06.2024	Lecture 5: Simulating pedestrians and cyclists	Heather Kaths
18.06.2024	Lecture 6: Traffic assignment and route choice	Heather Kaths
25.06.2024	Lecture 7: Calibration and validation	Heather Kaths
02.07.2024	Lecture 8: Alternative analysis	Heather Kaths
09.07.2024	Lecture 9: Simulation software	Heather Kaths
16.07.2024	Exam review	Danil Belikhov
TBD	EXAM	



## Important resources (on Moodle)

1. Barceló J (2010) *Fundamentals of Traffic Simulation*. New York: Springer-Verlag.
2. Bungartz H-J, Zimmer S, Buchholz M, et al. (2009) *Modellbildung Und Simulation: Eine Anwendungsorientierte Einführung*. Springer-Verlag.
3. Forschungsgesellschaft für Straßen- und Verkehrswesen, Hinweise zur mikroskopischen Verkehrsflusssimulation: Grundlagen und Anwendung, vol. 388. FGSV Verlag, 2006.
4. R. Dowling, A. Skabardonis, and V. Alexiadis, "Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software," Rep. No. FHWA-HRT-04-040, U.S. DOT, Fed. Highw. Adm. Washington, D.C, vol. III, no. July, p. 146, 2004.

Additional materials will be made available for each of the lecture topics.