AH2174 Traffic Simulation Modelling and Applications 7.5 credits

Trafiksimulering, modellering och applikationer

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for AH2174 valid from Autumn 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Specific prerequisites

For admitted students to the Master of Science in Civil Engineering and Urban Management (CSAMH) or the Master of Science in Transport and Geoinformation Technology (TTGTM):

- Traffic and Road Engineering or AH2171 Traffic Engineering and Management
- AH2170 Transport Data collection and Analysis

For other students:

- A completed bachelor's degree in civil engineering, urban planning, geomatics, geography, engineering physics, computer science, statistics, economics,mathematics, including at least 6 university credits (hp) in each of the following or their equivalents: Programming, Linear Algebra, Calculus in One Variable, and Probability & Statistics;
- English language proficiency equivalent to (the Swedish upper secondary school) English course B
- AH2171 Traffic Engineering and Management or an equivalent course;
- AH2170 Transport Data collection and Analysis

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

In this course, students obtain fundamental knowledge on the principles and applications of transport simulations.

Transport simulators are complex computer programs that solve complex model systems. The models describe real transport phenomena, such as traffic flow dynamics in urban networks. They are typically solved through mathematical techniques, in particular stochastic simulation methods. Real transport problems are analyzed with free or commercial software implementations of these models and solvers.

After successful completition of the course, students should be able to

- understand and apply the basic principles of simulation;
- interpret and analyze stochastic simulation results;
- select application-specific models and simulation methods;
- collect and use real data to calibrate and validate transport simulators;
- deploy simulations for scenario analysis, prediction, and optimization.

Course contents

This is an advanced course on transport simulation. It consists of lectures and exercises. The lectures are structured in two blocks of roughly equal size.

The first half of the lectures teaches fundamental concepts of simulation and its application in transport. This comprises: taxonomy of simulation approaches, scientific principles and mathematical simulation framework, input data preparation, computer simulation techniques, analysis of simulation outputs. These lectures provide a solid foundation to understand and use transport simulations.

The second half of the lectures treats a selection of more specific topics. This comprises: calibration and validation of simulators, experimental design, on-line simulation, simulation-based optimization. Students will have the opportunity to influence what topics the

course focuses on. These lectures provide the ability to solve complex, real transport problems with simulation.

The exercises investigate several case studies of increasing realism with an operational traffic simulator. The largest part of the exercises is hands-on work with the simulation software. Intermediate classroom-type exercises deepen the understanding of concepts taught in the lectures and clarify their relation to the case studies. The exercises give students practical experience with a real simulation software.

Course literature

- S. M. Ross, Simulation, 4th edition, Elsevier, 2006
- A. M. Law and W. David Kelton, Simulation Modeling and Analysis, 4rth edition,McGraw Hill, 2006.
- R. Dowling, A. Skabardonis, and V. Alexiadis, Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, FHWA-HRT-04-040.
- R. Roess, E. Prassas, and W. McShane, Traffic Engineering, 3rd edition, Prentice Hall, 2004.
- S. Washington, M. Karlaftis, and F. Mannering, Statistical and Econometric Methods for Transportation Data Analysis, Chapman & Hall/CRC, 2003.
- Selected papers and class notes
- Manuals of traffic simulation software to be used for projects and case studies

Examination

- PRO2 - Project Assignments, 3.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Oral Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

PRO1 - Assignments, 3.5 credits, grade scale: A, B, C, D, E, FX, F

TEN1 - Examination, 4.0 credits, grade scale: A, B, C, D, E, FX, F

Other requirements for final grade

A mandatory oral examination equivalent to 4.0 ECTS credits on the A-F grading scale and a mandatory project assignment equivalent to 3.5 credits with grading scale A-F. The course will be determined by the grade of both

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.