COURSE DESCRIPTION CARD - SYLLABUS

Course name
Traffic Modelling and Simulation - Pt. 1 [N1Trans1>MiSR1]

Course

Field of study
Transport

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
9

Laboratory classes
9

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Basic concepts of traffic engineering and rules of road traffic organization. Basic knowledge of modeling methods and computer simulations. The ability to approximate and discretize continuous problems. Numerical methods in the field of linear algebra and computer graphics. Basics of operating typical computer systems. Determining the hierarchy and schedule of tasks in formulating mathematical and numerical problems. Independence. Responsibility.

Course objective

Providing information on traffic modeling and simulation. Principles of developing macroscopic and microscopic traffic models. Classification and descriptions of macroscopic models. Classification and descriptions of microscopic models. Transformation of traffic descriptions from a continuous level to a discrete level. Development of traffic simulators using numerical methods.

Course-related learning outcomes

Knowledge:
The student has an ordered, theoretically founded general knowledge of technology, transport systems and various means of transport

The student knows the basic techniques, methods and tools used in the process of solving tasks in the field of transport, mainly of an engineering nature engineering
The student has knowledge of ethical codes regarding transport engineering, is aware of the dangers related to environmental protection and understands the specificity of mission-critical systems

Skills:
The student is able to obtain information from various sources, including literature and databases (both in Polish and in English), integrate it properly, interpret it and critically evaluate it, draw conclusions, and comprehensively justify his/her opinion.
The student can properly use information and communication techniques, applicable at various stages of the implementation of transport projects
The student is able to properly plan and conduct perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions
The student is able, when formulating and solving tasks in the field of transport, to apply appropriately selected methods, including analytical, simulation or experimental methods
The student is able - in accordance with the given specification - to design (create a model of a fragment of reality), formulate a functional specification in the form of use cases, formulate non-functional requirements for selected quality characteristics) and implement a device or a widely understood system in the field of means of transport, using appropriate methods, techniques and tools

Social competences:
The student is aware of the importance of knowledge in solving engineering problems, knows examples and understands the causes of malfunctioning transport systems that have led to serious financial and social losses or to serious loss of health and even life

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lectures: written test on the lecture material. Laboratory classes: individual reports on the conducted traffic simulations.

Programme content

Modeling and simulation. Basic parameters of the movement and relations between them. Movement measurements as the basis of mathematical description. Fundamental diagram. Classification of traffic models.
Macroscopic models: description and dependencies. LWR models for one variable (rate or density) and different static relationships. 2-equation models with the terms of convection, anticipation and relaxation. Review of 2-equation models and their classification. Symmetric (isotropic) and asymmetric (anisotropic) models. Conditioning of motion models: spectral radius and conditioning index.
Transformation of traffic models from continuous to discrete level. Discretization and approximation. Numerical methods of solving discretized motion models. Evaluation of traffic models.
Microscopic models: description and dependencies. Classification and discussion of microscopic models. Model limitations. Traffic simulators review. Rules for selecting a traffic simulator. Hybrid simulators and their types. Review of hybrid simulators.

Course topics

none

Teaching methods

1. Lecture: multimedia presentation. 2. Laboratory classes: conducting computer simulations of road traffic and development of simulation results.

Bibliography

Basic
1. Treiber M., Kesting A., Traffic flow dynamics. Data, models and simulation, Springer-Verlag, Berlin Heidelberg 2013

2. Daamen W., Buisson Ch., Hoogendoorn S.P., Traffic simulation and data. Validation methods and applications, CRC Press, Boca Raton 2014
3. Traffic flow theory, A state-of-the-art report (ed. Gartner R., Messer C.J., Rathi A.K.), TRB 1995
4. Barceló J., Fundamentals of traffic simulation, International Series in Operations Research & Management Science, vol. 145, Springer 2010
Additional
1. Adamski A., Inteligentne systemy transportowe: sterowanie, nadzór i zarządzanie, Kraków, UWN 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	28	1,00
Classes requiring direct contact with the teacher	18	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50