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201400147

Modelling & Analysis of Stochastic Processes for CE

Course info

Course module	201400147	**Starting block**	2B
Credits (ECTS)	15	**Application procedure**	You apply via OSIRIS Student
Course type	Module	**Registration using OSIRIS**	Yes
Language of instruction	English	**Number of insufficient tests**	-
Contact person	ing. K.M. van Zuilekom		
E-mail	k.m.vanzuilekom@utwente.nl		

Lecturer(s)

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Lecturer	prof.dr.ir. E.C. van Berkum
Lecturer	prof.dr. R.J. Boucherie
Lecturer	ir. J.G. de Kiewit
Lecturer	dr.ir. M.R.K. Mes
Lecturer	dr.ir. W.R.W. Scheinhardt

Learning goals

1. Traffic Flow Dynamics and Simulation (CE specific). After successful completion of this part, the student is able to:
   a. determine queues and delays at a traffic light
   b. determine shockwaves as a result of disturbances (due to individual behaviour and/or spatial changes) using the fundamental diagram.
   c. understand microscopic and macroscopic traffic flow variables and their relations.
   d. set up experiments in a simulation environment to evaluate road design, e.g. highway design (on/off-ramps, weaving), intersection design (with/without traffic lights, roundabout)
   e. process and analyse traffic data (from measurements or simulations)

2. Simulation and heuristics. After successful completion of this part, the student is able to:
   a. describe the different types of simulation, their applicability, and how to setup a simulation study;
   b. understands the core principles of discrete event simulation (e.g., the event controller, random numbers, and warm-up period);
   c. design and implement a conceptual simulation model in a simulation environment, according to the project specifications;
   d. define input for a simulation model (e.g., different statistical distributions) and design experiments (e.g., combination of experimental factors, ranges, performance indicators);
   e. perform simulation experiments, interpret the outcomes of the simulation, and formulate recommendations that are useful for the problem owner;
   f. explain the concepts of (i) construction and improvement heuristics and (ii) local search heuristics;
   g. apply construction and improvement heuristics and local search heuristics to solve relatively simple problems.

3. Multidisciplinary project. After successful completion of this part, the student is able to:
   a. communicate and collaborate with students of different educational backgrounds;
   b. select appropriate modelling tools (from the set of tools provided in this module) for a large real-life problem, and use them to model and solve the problem.
   c. interpret the outcomes of the before mentioned tools and formulate practical recommendations for system improvement;
   d. inform and convince the problem owner by means of a report and presentation.

4. Professional Skills (CE specific). After successful completion of this part, the student is able to:
   a. analyse personal qualities and relate the results of this analysis to his/her study plan

Content

This module is built around a number of key knowledge domains, namely Traffic Flow Dynamics, Micro Simulation of Traffic Flows, heuristic methods, and simulation. These subjects make it possible to model and analyze complex real-word problems in which uncertainty is involved. For example simulation can be used to determine the required number of operating rooms within a hospital and micro traffic simulation can be used for evaluation of new infrastructure.
Project assignments are used to model real-world problems, solving the models with computer packages, and analyzing and interpreting the results. Much attention is paid to selecting the appropriate tool to tackle a problem, to translate the problem in an appropriate model, and to translate the outcomes back to reality and provide recommendations.
The part Professional Skills consists of three workshops and two assignments. During the first workshop the student uses a questionnaire and experiences from prior modules to identify strong and weak qualities. The student will illustrate this using (STAR) examples. On the basis of this analysis the student defines learning goals (assignment 1). In a second workshop the students makes an inventory of preferences for future working environments. Information on finding a bachelor thesis assignment is given. Based on this information the student writes a CV and an application letter (assignment 2). In a third workshop the CV and application letter are evaluated. Application interviews are rehearsed.

Assumed previous knowledge

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PARTICIPATING STUDY

B-CIT

Required materials

Course material
S. Robinson, Simulation (2014). The Practice of Model Development and Use (2nd editon), Palgrave

Recommended materials

Book
A book on Traffic Flow Dynamics has to be decided yet

Instructional modes

Final thesis (Required)

Lecture

Practical

Presentation(s) (Required)

Project

Self study without assistance

Tutorial

Tests

Traffic Flow Dynamics and Simulation

Remark
1 exam with MC and open questions

Project Micro Simulation of Traffic Flow

Remark
1 report

Modelling and Simulation

Remark
1 exam with MC and open questions

Project Simulation

Remark
1 report (+ models) and presentation

Multidisciplinary Project

Remark
1 report (+ models) and presentation

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