CIVIL-534

Computational systems thinking for sustainable eng.

Sonta Andrew

Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.
Minor in Engineering for sustainability	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course integrates systems thinking and network analysis through theory and computing. The objective of this course is to develop expertise in computationally analyzing and modeling complex systems in civil and urban systems engineering, with a particular emphasis on advancing sustainability.

Content

- Introduction to systems thinking: theory and applications
- Computational modeling of system dynamics
- Systems and sustainability (case studies on resource use and environmental impacts)
- Introduction to network analysis
- Computational modeling of networks with built environment applications
- Integrating computational and systems thinking
- Using computational tools for engineering decision-making for advancing sustainability

Keywords

Systems thinking, system dynamics, network analysis, computational modeling, sustainability

Learning Prerequisites

Required courses

Introduction to machine learning for engineers (CIVIL-226)

Recommended courses

Linear algebra (MATH-111)

Important concepts to start the course

Coding in Python, background in calculus and linear algebra

Learning Outcomes

By the end of the course, the student must be able to:

- Explain what comprises a complex system in the built environment
- Model complex urban systems and system dynamics
- Explain the characteristics of graphs and networks
- Use network analysis to describe complex systems
- Develop and model strategies for intervening in systems to advance sustainability objectives

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Take account of the social and human dimensions of the engineering profession.
- Demonstrate the capacity for critical thinking

Teaching methods

Lectures, exercises, and activities

Assessment methods

2 exams during the semester (40%)
Exercises (30%)
Course project (30%)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

- Thinking in Systems: A Primer, Donella H. Meadows, 2008
- Networks, 2nd Edition, Mark Newman, 2018

Ressources en bibliothèque

- Networks / Newman (2nd ed.)
- Thinking in Systems / Meadows

Moodle Link

- https://go.epfl.ch/CIVIL-534