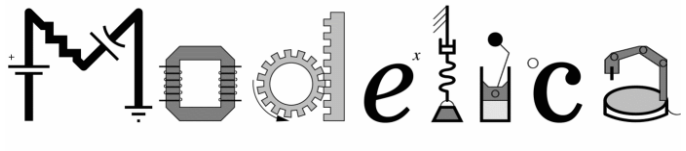
PhD course

25-27 August 2025

Modelica-based simulation of building and district energy systems



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SESSION 0: Practical information

- Teaching team
- Participants
- Agenda
- Misc
- Access to Modelon Impact

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TEACHING TEAM

Alessandro Maccarini
Assoc. Prof. @AAU

Mathias Strandberg
Principal Application Engineer @Modelon

Mohammed B. Rabani
PhD student @AAU

Johan Windahl
Product Manager @Modelon

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PARTICIPANTS (21)

Denmark (7)
- Technical University of Denmark (6)
- Aarhus University (1)

USA (5)
- North Carolina State University (1)
- University of Alabama (1)
- Louisiana State University (1)
- Vigilent (1)

Italy (3)
- Politecnico Torino (3)

Spain (1)
- Universitat Politècnica de Catalunya (1)

UK (1)
- University of Edinburgh (1)

Estonia (1)
- Tallinn University of Technology (1)

Canada (1)
- Université du Quebec (1)

Sweden (1)
- Linnaeus University (1)

Finland (1)
- Vaasa University (1)

India (1)
- Indian Institute of Technology Madras (1)

09:00–09:30: SOCIAL **Welcome coffee**

09:30–10:00: INTRO **Overview of the course**
- Short presentation of instructors and participants
- Software installation and practical info

10:00–10:30: LECTURE **Session 1 / Introduction to system modeling**
- Systems, models and simulation
- Building performance simulation tools
- A first overview of Modelica

10:30–11:45: LECTURE **Sessions 2 / Modelon Impact overview and workflow I**
- Creating new models / Settings parameters
- Workflow: Simulate and plot

EXERCISE Building, simulating and analyzing a physical system

11:45–12:45: FREE **Lunch**

12:45–14:15: LECTURE **Session 3 / Modelica overview**
- Text editor
- Variables and parameters
- Equation-based components

EXERCISE "Hello World" in Modelica

EXERCISE Getting physical: Cooling an object with air

14:15–14:45: FREE **Break**

14:45–16:00: LECTURE **Session 4 / Modelon Impact overview and workflow II**
- Library packages
- Parameter interface
- Documentation and Icon

EXERCISE Component design

16:00–17:00: GUEST LECTURE **Session 5 / Modelica Buildings Library (by Michael Wetter)**
- Overview, organization and packages
- Related projects that build on MBL
- Discussion

09:00–10:15: HANDS-ON TRAINING **Session 6 / Modeling a simple house**
- Building envelope (walls and windows)
- Weather boundary conditions

10:15–10:30: FREE **Break**

10:30–11:45: HANDS-ON TRAINING **Session 7 / Heating system**
- Radiator
- Sensors and controls

11:45–12:45: FREE **Lunch**

12:45–14:00: HANDS-ON TRAINING **Session 8 / Air-based cooling system I**
- Thermal zone
- Ventilation and fans and cooling machine

14:00–14:15: FREE **Break**

14:15–16:00: HANDS-ON TRAINING **Session 9 / Air-based cooling system II**
- Cooling machine
- Control system

16:00–17:00: GUEST LECTURE **Session 10 / Modelica in action: Real-world applications for district heating (by Rene Just Nielsen)**
- Process models used in district heating project
- Control design for real-world implementation
- Challenges and outlook

09:00–10:15: HANDS-ON TRAINING **Session 11 / District heating system I**
- Heating demand profiles
- Substations

10:15–10:30: FREE **Break**

10:30–11:45: HANDS-ON TRAINING **Session 12 / District heating system II**
- Central thermal plant
- Piping distribution network
- Ground heat losses

11:45–12:45: FREE **Lunch**

12:45–14:30: FINAL ASSIGNMENT I **Session 13**
- Presentation of the final assignment
- Starting to work on the assignment in class

14:30–15:00: SOCIAL **Sweet reflections: Cake and course feedback**
- Coffee and sweets
- Q&A
- Feedback from students

15:00–16:00: GUEST LECTURE **Session 14 / Cutting-edge innovations at the intersection of Modelica and AI (by Adam Nagel)**

16:00–17:00: FINAL ASSIGNMENT II **Session 15**
- Continuing to work on the final assignment

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MISCELLANEOUS

❑ **In-person vs online**

This course is primarily designed for in-person participation, as providing effective remote support (especially for debugging models!) can be challenging. However, a limited number of online spots have been made available to ensure greater accessibility (living oversea / VISA issues)

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❑ **Lunch**

We'll head to the canteen on the first floor, where you can grab a meal for around 4 to 6 EUR.

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❑ **Lunch**

We'll head to the canteen on the first floor, where you can grab a meal for around 5 to 7 EUR.

❑ **Official certificate (3 ECTS)**

If you would like to receive the official course certificate, you'll need to complete an individual assignment, which must be submitted within two weeks after the course ends.

The Modelica language and Modelica tools

Modelica is a language, not a tool!

Modelica (language)

- Modelica Association (open, non-profit)
- Provides:
  - Modelica language
  - Modelica Standard Library (MSL)

Tools

OpenModelica

- Supported by Open Source Modelica Consortium (OSMC)
- Open-source software

Modelon Impact

- Developed by Modelon
- Commercial software

Dymola

- Developed by Dynasim AB (acquired by Dassault Systemes)
- Commercial software

These are just a few of the available tools. You can find the full list at: https://modelica.org/tools/

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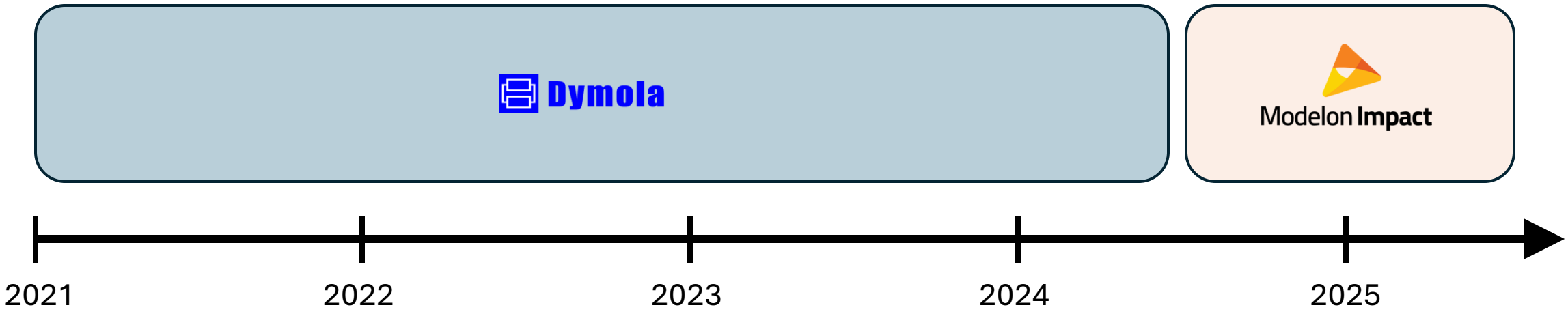
This is first edition of the PhD course featuring **Modelica Impact** as simulation tool



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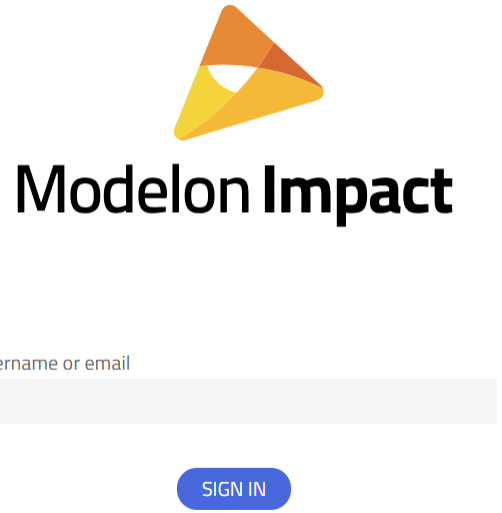
ACCESS TO MODELON IMPACT

Credentials sent out with welcome email.
You will be prompted to update the password.

https://impact.modelon.cloud



Setting up the workspaces

We have prepared content for you!

Once you logged in, you can follow the links below:

- Workspace for the course:
  - Impact workspace: ModelicaTraining2025
- Modelon Impact course materials:
  - Impact workspace: ImpactTraining

- Note: you only need to do this once, then the workspaces are available at login.

Help-center:

- https://help.modelon.com