MSc and PhD level short course, 4–10 August 2026
Location: Elektrovej, building 329A, room 120, Kgs. Lyngby, DK 2800
For all interested participants

Principles of Modelling, Simulation and Control for Efficient/Reliable/Resilient Electricity Service

Prof. Marija Ilic (MIT / DTU Visiting Professor)

Course topics overview

1. Examples of electric power systems; performance objectives; Engineering IT-Enabled Electricity Services

2. State Space Modelling for Electric Energy Systems; Intro to Energy Conversion Dynamics; Synchronous Machine and its Dynamical Model; Solar PVs, Wind Power, Storage Modelling

3. From components to systems: objectives, modelling, control and simulations

4. Tertiary level control; optimization for feedforward; scheduling; Model predictive economic dispatch

5. Power delivery problem formulations: a) DC power flow and AC power flow (analysis); b) DC Optimal power flow (DC OPF) and AC Optimal Power Flow (AC OPF) (decision/optimization); (N-1) reliability and (N-k) resiliency problems

6. Tasks underlying today's electricity services; Hierarchical control and enabling algorithms; Beyond today's Hierarchical Control; Relaxing assumptions

7. Structure-preserving modelling of area dynamics in interconnected systems using interaction variables; multi-layered energy dynamics modelling and control; energy dynamics control of Grid Forming (GFM) and Grid Following (GFL) technologies

8. Implementation of efficient and reliable electricity service at value; Distributed model predictive control and storage; Toward implementable complete markets to support innovation at value; next generation SCADA

Schedule

Day 1		Day 2		Day 3		Day 4		Day 5	
10:00–12:00	Topic 1	10:00–12:00	Topic 3	10:00–12:00	Topic 4B	10:00–12:00	Topic 6A	10:00–12:00	Topic 7
Lunch break		**Lunch break**		**Lunch break**		**Lunch break**		**Lunch break**	
13:15-14:00	Interactive session	13:15-14:00	Interactive session	13:15-14:00	Interactive session	13:15-14:00	Interactive session	13:15-14:00	Interactive session
14:00-16:00	Topic 2	14:00-16:00	Topic 4A	14:00-16:00	Topic 5	14:00-16:00	Topic 6B	14:00-16:00	Topic 8

Assignment and student engagement

Individual report

(if ECTS are required)

6–10 pages, individual

Literature review, survey, or small analytical / calculation-based task

Directly linked to one or more course topics

Short topic proposal during the course

Final submission after course

In-class engagement

Daily discussions

Short pair or small-group exercises

Final wrap-up: one key insight + one open question per student


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