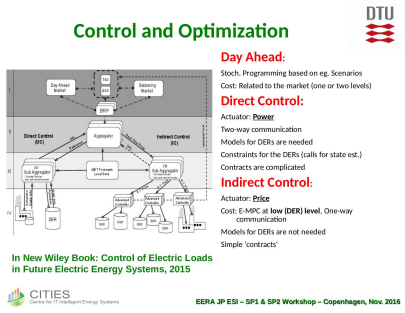
Time Series Analysis - with a focus on modelling and forecasting in energy systems

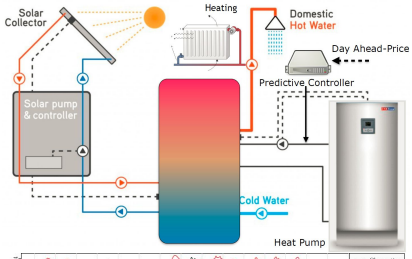
Summer School Announcement

Venue: DTU, Copenhagen, Denmark
Date: August 27-31, 2018

To integrate renewable and fluctuating power generation sources we need to model, forecast and optimize the operation of distributed energy resources, hence we need self tuning models for each component in the system. Eg. for a building with PV and a heat pump, one will need a model from weather forecasts and control variables to: PV power, heat pump load and the indoor temperature in the building. These, together with electricity prices, can then be used for MPC of the heat pump to shift its load to match the generation of power. There are many other applications of data-driven models, eg. performance assessment, flexibility characterization, and fault-detection; these topics will also be presented. The statistical techniques behind the models will be elaborated, with focus on non-parametric (eg. kernels and splines) models, discrete and continuous time models (grey-box modelling with SDEs).

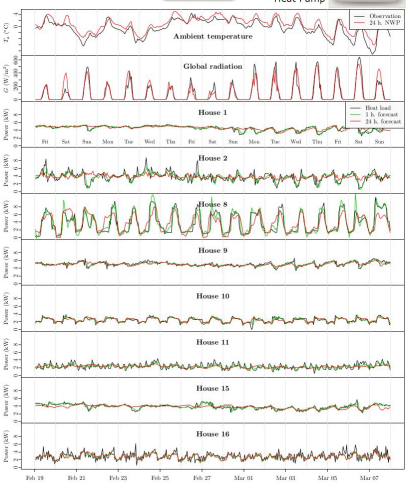


We will use R and provide exercises to get a “hands-on” experience with the techniques. The summer school will be held at DTU in the days 27. to 31. of August, 2018. PhD students completing the course will achieve 2.5 ECTS points. There will be a fee of 350 Euros for students (higher for industry participants).



A student who has met the learning objectives of the course will be able to:

- Achieve thorough understanding of maximum likelihood estimation techniques.
- Formulate and apply non-parametric models using kernel functions and splines - with focus on solar and occupancy effects.
- Formulate and apply time adaptive models.
- Formulate and apply models for short-term forecasting in energy systems, e.g. for heat load in buildings, electrical power from PV and wind systems.
- Application of statistical model selection techniques (F-test, likelihood-ratio tests, model validation).
- Formulate and apply grey-box models - model identification - tests for model order and model validation, and advanced non-linear models.
- Achieve understanding of model predictive control (MPC) - via applied examples on energy systems.
- Achieve understanding of flexibility functions and indices.



$$\min_{\{u_k\}_{k=0}^{N-1}} \phi = \Sigma_{k=0}^{N-1} c' u_k$$

$$\text{Subject to} \quad x_{k+1} = Ax_k + Bu_k + Ed_k$$
$$y_k = Cx_k$$
$$u_{min} \leq u_k \leq u_{max}$$
$$\Delta u_{min} \leq \Delta u_k \leq \Delta u_{max}$$
$$y_{min} \leq y_k \leq y_{max}$$

Following the summer school we will offer the students to work on a larger and practical related problem, and based upon an agreement with the teachers this can lead to 5 ECTS. The summer school held at DTU i collaboration with NTNU, as well as IEA Annex 67 and 71. The summer school is arranged by the centers CITIES http://smart-cities-centre.org/ and ZEN www.sintef.no/prosjekter/zen/.

Registration via (do both): PhD_registration and Conference_manager
(USE: Course number and title: 02960 Time Series Analysis - with a focus on Modelling and Forecasting in Energy Systems)

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ZERO EMISSION NEIGHBOURHOODS IN SMART CITIES

CITIES
Centre for IT Intelligent Energy Systems

DTU Compute
Department of Applied Mathematics and Computer Science