DYNASTEE
NEWSLETTER ISSUE 2020/16

Foreword

I hope this Newsletter reaches you in good health. The current COVID-19 pandemic has drastically changed the ways in which we learn and work, collaborate and socialize.

As a result of the measures that are being taken to prevent the further spreading of the virus, both the DYNASTEE Summer School on Dynamic Calculation Methods for Building Energy Performance Assessment and the DTU Summer School on Time Series Analysis with a focus on modelling and forecasting in energy systems, will take place digitally.

Just days before all travel and meetings would be restricted, the 2nd European SimStadt Workshop took place at Saxion UAS in the Netherlands. You'll find an article on the workshop and the ELISE project in this issue. This 16th DYNASTEE Newsletter also contains an article on Model Predictive Control applied to thermostatic controlled systems.

Finally, the NSB 2020 conference in Tallinn (Estonia) has been rescheduled to 6 – 9 September 2020. I hope we will be able to physically meet again by then. Take care.

Twan Rovers, Saxion University of Applied Sciences

Individual shading and/or cooling of appartments

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DYNASTEE
Newsletter Editors
Hans Bloem, INIVE
Twan Rovers, Saxion University of Applied Sciences
Christian Struck, Saxion University of Applied Sciences

DYNASTEE Management Board

Since January 2020, the DYNASTEE board has strengthened its management team and is hence been extended to five persons. Maria-Jose Jimenez and Richard Fitton have agreed to join Peter Wouters, Luk Vandaele and Hans Bloem.

María José Jiménez holds a PhD in Physics and has been working for the CIEMAT (Public National Research Institution dedicated to Energy and Environment) since 1992. She is Head of CIEMAT group for Experimental Energy Analysis in Buildings and member of several International Committees related to Building Energy Performance Assessment. Her expertise is in the areas of Building Physics, Measurements in the built environment, System identification applied to energy performance assessment of buildings - Bridging physics and statistics, and tests and analysis in warm and sunny weather.

Richard Fitton (University of Salford, Manchester, UK) holds a PhD in Building Physics and is also a chartered building surveyor. He leads a task group for the development of international standards around energy performance. He is also active in the International Energy Agency studying the use of smart meter data to provide energy efficiency data for dwellings. He holds a place on the SAP Scientific Integrity Group at the Building Research Establishment (BRE) which oversees the domestic energy model used in the UK. Richard is also the technical lead for the new Energy House 2 project, a building physics test lab.

Postponement of the Summer School 2020 in Almeria

on "Dynamic Calculation Methods for Building Energy Performance Assessment"

As you may notice, the COVID-19 pandemic has made organisation and travel arrangements impossible because of restrictions in many countries. The Summer School organisers have decided to move the Summer School 2020, scheduled in September 2020 in Almeria, to June 2021.

However, DYNASTEE is currently developing more on-line support. See below for details. A series of three webinars in one month of each 2 hours will be organized, presenting short lectures and some exercises for the time between the webinars. This may take place in September 2020. These webinars are only for registered on-line participants who will receive the lecture presentations and the data together with the exercises after each webinar. This proposal is only a minimal substitute for the week-long Summer School. So the webinars cannot be compared with the physical Summer School, where a close interaction between lecturers and participants is taking place. It should be considered as a helping hand to get started with Dynamic Calculation Methods for Building Energy Performance Assessment. More information on the www.dynastee.info website.

Feel free to contact mjose.jimenez@psa.es or hans.bloem@inive.org to be placed on the Summer School mailing-list and you will receive further information as soon as available.

DYNASTEE On-line Training

The present situation that the Corona-virus has created, concerning travelling and accommodation, has made the DYNASTEE board to decide that it will support on-line training. It will do so by organising a series of webinars during a period of one month (on a fixed day per week 10-12 h). Each webinar will be composed of two lectures and introduce an exercise using data that will be made available to the participants for training.

The option of one webinar per week has been mentioned which means that a series of 3 webinars (e.g. 6 lectures) will be distributed over a month followed by a Q&A webinar. An additional short introduction webinar is suggested, presenting briefly DYNASTEE, its history, activities and the webinar as the substitute Summer School. The webinars will be recorded and made available on the internet.

Title: DYNASTEE On-line Training for Dynamic Calculation Methods for Building Energy Performance Assessment

How to register for the on-line training webinars? Further information about registration, the webinar schedule, lecturers and contents will be announced on the DYNASTEE web-site www.dynastee.info There will be no fee to attend the webinars.

What is in for you? Having attended to the webinars the participant will be able to understand the topic of dynamic analysis applied to in-situ measured data series, the basic mathematical and statistical analysis techniques, applicable software and benchmark data to build a level of skill.

Programme

Webinar 1: 30 minutes; *2 September 11:00 – 11:30*

A short introduction webinar is suggested, presenting briefly DYNASTEE and its history, outdoor experimental activities, training of analysis techniques and the proposed series of webinars as a substitute for the Summer Schools held from 2012 until 2019.

Webinar 2: *9 September 10:00 – 12:00*

Introduction to Dynamic Calculation Methods and quick overview of the software tool LORD. Building confidence in analysis. Exercise: an easy, conduction-only exercise with simulated data (result is given to the participants to gain confidence).

Webinar 3: *16 September 10:00 – 12:00*

Introduction to measured data, instrumentation and sensors in relation to building physics and energy performance. What is important to know? Exercise: in-situ wall measurement with and without solar radiation. This is the >25 years applied data from a reliable outdoor measurement of a wall.

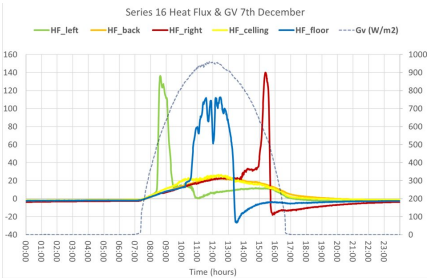
Webinar 4: *23 September 10:00 – 12:00*

Introduction to discrete time and continuous time methods (CTSM-R) and models together with statistical tools. Combining two disciplines; building physics and mathematical techniques. Exercise: PSA data series 16, 17. An overview will be given of available data and analysis topics, including short examples.

Webinar 5: *30 September 10:00 – 12:00*

Questions and Answer webinar. Feedback and questions from participants.

The Summer School organisers have decided to move the weeklong Summer School 2020, scheduled in September 2020 in Almeria, to **June 2021**.



Solar radiation issues

Testbox at PSA Almeria, Spain

Online Summer School at DTU, August 24-28, 2020

registration before June 15

By Henrik Madsen & Peder Bacher (DTU, DK)

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

Due to the COVID-19 situation, DTU is currently locked down and we don't know if it will be open for the week of the summer school. Further, it's probably not going to be possible to travel to Denmark. Therefore, it will be possible, in any case, to participate in the summer school via **on-line** means. We will stream the lectures and will provide online interaction for all participants and assistance during exercises. The cost of participating on-line will be 150 Euros. Find the full announcement details by the link to the homepage of CITIES:

http://smart-cities-centre.org/2020/04/21/join-summer-school-time-series-analysis-with-a-focus-on-modelling-and-forecasting-in-energy-systems/

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. E.g. 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, e.g. 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 (e.g. kernels and splines) models, discrete and continuous time models (grey-box modelling with SDEs).

The summer school organised by DTU in a collaboration with NTNU and IEA EBC Annexes 71 and 82. The summer school is arranged by CITIES

www.smart-cities-centre.org/

and ZEN

www.sintef.no/prosjekter/zen/.

For more information, contact Henrik Madsen (hmad@dtu.dk), Peder Bacher (pbac@dtu.dk)

The project SimStadt 2.0 (Funding number: 3ET14594) is supported by the German Ministry of Economics.

ELISE
European Location Interoperability Solutions for e-Government
Get started: ELISE Action page

2nd European SimStadt Workshop at Saxion University of Applied Sciences in Enschede (NL)

By Martinus Franken (Kadaster BV, NL), Volker Coors (HFT Stuttgart, D), Matthias Fitzky (HFT Stuttgart, D), Christian Struck (Saxion UAS, NL), Twan Rovers (Saxion UAS, NL), Gema Hernández Moral (CARTIF, ES), Fabio Vinci (CARTIF, ES), Giacomo Martirano (Joint Research Centre of the European Commission, IT), & Francesco Pignatelli (Joint Research Centre of the European Commission, IT)

On the 11th of March, just a few days ahead of COVID – 19, the team working on the ELISE Use Case "Comparative analysis of different methodologies and datasets for Energy Performance Labelling of buildings" organized the 2nd European SimStadt workshop at Saxion University of Applied Sciences in Enschede, hosted by the Saxion research group Sustainable Building Technology (SBT).

SimStadt is a workflow-driven urban energy simulation platform for CityGML city models enabling solar potential- , heating demand- , environmental- and district heating network analysis. Linking urban simulation platforms to CityGML models allows the use of geospatial information to enrich data models to be used for scenario analysis, e.g. related to energy transition. However, the rapid and widespread development of applications and tools requires the European Commission to focus on harmonization measures for data formats.

Within ELISE, the European Location Interoperability Solutions for e-government initiative, a number of pilot projects are executed with the aim to test principles in practice, offer lessons and resources for others to build upon, provide the basis for a widespread rollout, and show the benefits of location interoperability. One of the pilot projects executed under the ELISE "Energy & Location Applications" is the Use-Case: "Comparative analysis of different methodologies and datasets for Energy Performance Labelling of buildings".

The use case is supported by five institutions (Kadaster, Saxion Hogeschool, CARTIF, Hochschule Stuttgart, Joint Research Centre) from four countries (The Netherlands, Germany, Spain and Italy). The aim of the use-case is twofold:

- To make a comparative analysis of different methodologies for Energy Performance Labelling of buildings, applied to sample datasets of buildings in DE, NL and ES.
- To make the analysis results re-usable in other geographical areas (Member States) by parties aiming to assess the energy performance labels of their building stock and interested to preliminary assess costs & benefits of applying the same (or similar) methodologies based on the availability of similar datasets, with respect to those used in the comparative analysis.

INSPIRE BU 3D and CityGML data formats for determining energy labels on district scale in four test areas [Essen (DE), Zwolle (NL), Enschede (NL) and Valladolid (ES)] will be utilized, using SimStadt as urban energy simulation reference platform. The experience from the comparative analysis using the above mentioned data formats will be documented and shared within the ELISE community.

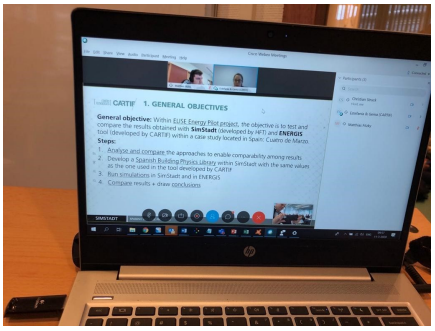
During the morning session of the workshop, four experts presented their research and development activities predicting energy labels with SimStadt on the different case studies, namely Prof. Dr. Volker Coors & Eric Duminil (Hochschule Stuttgart, D); Matthias Fitzky (New York University, Abu Dhabi) and Gema Hernández Moral (CARTIF, ES). In the afternoon, the 38 participants ranging from (PhD) students to industry partners were given the opportunity to trial the simulation platform on the Dutch case of Enschede. The user-friendliness of the workflow driven user interface of SimStadt surprised even the novice users of SimStadt. The next step will be to complete the simulation of the case studies and to compare the simulation results on three different levels:

(1) Level of detail of the geometrical data: impact of LOD on prediction accuracy;

(2) Intermodel comparison: accuracy assessment between simulation models on city and building scale (monthly and hourly averages) and

(3) Absolute performance prediction: comparison of predicted and measured data (multi- and single building scale).

Volker Coors & Christian Struck



Online lectures by Matthias Fitzky & Gema Hernández Moral

Discussion during the workshop

Participants of the workshop

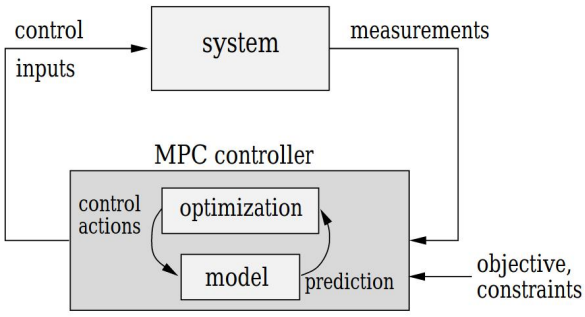
Model Predictive Control applied to thermostatic controlled systems

By Florencia Lazzari, Gerard Mor, Jordi Cipriano, Eloi Gabaldon, Stoyan Danov, Benedetto Grillone, Daniel Chemisana (CIMNE)

A Model Predictive Control (MPC) is a mechanism which, by controlling several variables comprising a system, allows to keep some parameters between the margins of some prefixed constrains. Control inputs are set by the MPC into the system and measurements of other parameters of the system are used as feedback to the MPC. In this study a MPC was developed to optimize the performance of the heatpump installed in the Twin house O5. The real system was nor controlled nor measured in reality, but a Modelica emulator of the house with its heat pump was used. The building's thermal behavior model was developed as an Auto-Regressive linear model with eXogenous variables (ARX) and the optimization algorithm was based in a genetic algorithm. The energy performance of a household depends on several features, these can be grouped in: indoor climate and outdoor weather parameters, construction characteristics of the building, type of heating ventilation and air conditioning (HVAC) system, and thermostatic control. Thus, the governing equations proposed to model the electric consumption of the thermostatic system intends to replicate the relations between the mentioned variables in the most complete and at the same time computationally economical way. With this focus, a methodology was developed to accurately predict the energy consumption of the thermostatic-controlled heating system of the emulated house when set point temperature is modified. The implemented model to predict the building's thermal behaviour is composed of three equations proposed in a highly intelligible formulation. The coupled equations describe the dynamics of the electric consumption, the supply temperature and the interior temperature. And the thermostatic control is allowed through the set point temperature of the heat pump. The complete system of equations was trained with historical data given by the emulator. The MPC was implemented and tested using a cost function which was defined after analysing the system thoroughly. Encouraging results were obtained, with savings up to 37% when comparing with historical data for a validation day. Concluding, the proposed predictive model to characterize the building's thermal behavior was developed successfully. Moreover, the MPC is already implemented and validated, but the total integration with the emulator of the system and the feedback loop has not been yet assembled. In this way, we are looking towards to end this task and complete the further analysis.

The complete article can be downloaded from:

https://www.scipedia.com/profile/flazzari



MPC environment

New dates for NSB 2020

As the COVID-19 pandemic has made travel arrangements impossible, the organisers have decided to move NSB 2020 according to recommendations of authorities to be held after the summer holidays. New dates for NSB 2020 are **6 – 9 September 2020**. New early bird registration deadline is **28 June**.

The conference may be attended virtually (video presentation) or physically with a somewhat smaller social program.

See www.nsb2020.org

ABOUT DYNASTEE

DYNASTEE stands for: "DYNamic Analysis, Simulation and Testing applied to the Energy and Environmental performance of buildings". DYNASTEE is a platform for exchange of knowledge and information on the application of tools and methodologies for the assessment of the energy performance of buildings. DYNASTEE functions under the auspices of the INIVE EEIG and it is open to all researchers, industrial developers and designers, involved in these subjects.

The EU energy research projects PASSYS (1985-1992), COMPASS and PASLINK created the initial European network of outdoor test facilities, developed test methods, analysis methodologies and simulation techniques. It resulted eventually into the PASLINK EEIG network (1994). The network profiled itself as a scientific community of experts on Testing, Analysis and Modelling. In 1998, PASLINK EEIG started a new project: PVHYBRID-PAS, on the overall performance assessment of photovoltaic technologies integrated in the building envelope. The use of the outdoor test facilities in several member states situated in different climates, together with the available expertise on analysis and simulation techniques, offered the ingredients for more successful projects: IQ-TEST (2001), focusing on quality assurance in testing and analysis under outdoor test conditions, as well as evaluation techniques of collected in-situ data. The expertise of the network was also offered to other European projects, such as DAME-BC, ROOFSOL, PRESCRIPT, IMPACT and PV-ROOF.

In 2005, the EEIG was converted into an informal network that today is known as DYNASTEE. It is offering a network of excellence and should be considered as an open platform for sharing knowledge with industry, decision makers and researchers. It has been very active in supporting projects such as the IEA-EBC Annex 58 and more recently the IEA-EBC Annex 71 'Building energy performance assessment based on in-situ measurements'.