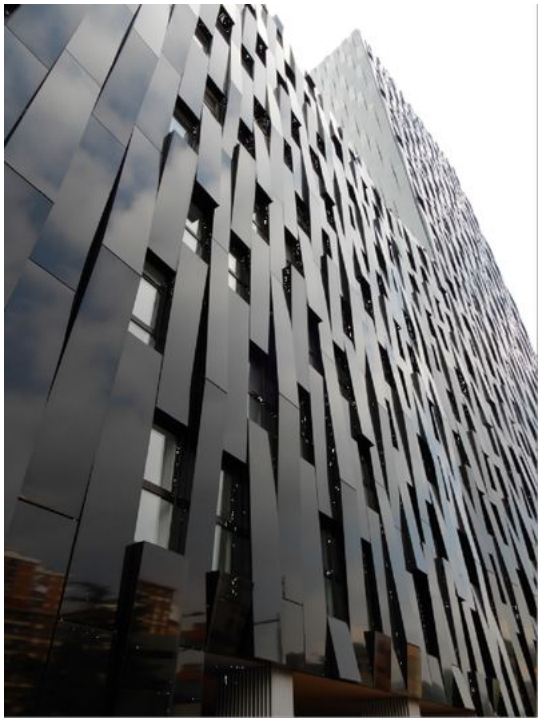
DYNASTEE
NEWSLETTER ISSUE 2019/13

Foreword

Already a new DYNASTEE Newsletter that contains three announcements. First of all the 8th Summer School with focus on energy performance of buildings that will take place this summer in Granada, Spain. A second Summer School on modelling and forecasting in energy systems that will take place in Copenhagen, Denmark and finally the announcement of the Nordic Symposium 2020, that will take place in Tallinn, Estonia. In the frame of the 6th IEA-EBC Annex 71 meeting a symposium was organised by DYNASTEE for which you will find a short summary article. A contribution article on thermography for building energy auditing is included also. Finally, the building on the right is the highly interesting and tallest passive house in the world, the Bolueta tower on the outskirts of Bilbao.

Luk Vandaele, DYNASTEE - INIVE



World's tallest passive house in Bilbao

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Newsletter Editors

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International Doctoral Summer School University of Granada Dynamic Methods for whole Building Energy Assessment 9 – 20 September 2019, Granada, Spain

After 7 very successful editions of the Summer School on "Dynamic methods for whole building energy assessment" the organisers have decided to offer, in collaboration with the University of Granada, a two-weeks doctoral course that focuses more on pragmatic application of dynamic calculation techniques, meaning that the analysis of building energy data is of high importance and can give potentially high value information to utility and end-user. The focus will be on increased complexity, presenting different approaches and application to benchmark data. Read the full text of the Announcement and Introduction to the summer school on the web-site www.dynastee.info

The cost for the two-weeks Summer School is 475 Euro. In case that the participant decides to follow the course for one week, either Level 1 or Level 2, the cost is 290 Euro. Participants should do a pre-registration by sending a notification to Marta Ruiz, e-mail: mruiz.serviciosexternos@psa.es

Deadline for submission is 15th July 2019

Upon pre-registration further information will be sent about accommodation and participation fee payment procedure.

DYNASTEE

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

Summer School Announcement - Venue: DTU, Copenhagen, Denmark - Date: 26-30 August , 2019

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, 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).

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 summer of 2019. PhD students completing the course will achieve 2.5 ECTS points. There will be a fee of 250 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.

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 EBC Annexes 67 and 71. The summer school is arranged by the centers CITIES http://smart-cities-centre.org/ and ZEN www.sintef.no/prosjekter/zen/.

For more information, contact Henrik Madsen (hmad@dtu.dk) or Peder Bacher (pbac@dtu.dk). See also DTU course 02960.

The building as the cornerstone of our future energy infrastructure - The importance of dynamic and real data for reliable assessement

Outcome of the SYMPOSIUM, that took place 10-11 April 2019 in Bilbao, Spain.

The DYNASTEE network took the initiative to organise a symposium to bring into discussion the future of the building stock in a changing society where climate issues, information and communication technology, renewable energy technologies and the citizen will play an important role. The aim of the symposium was to present and discuss the challenges that the energy transition may create for companies, governments, researchers and most importantly, the citizen. Several topics that will have an impact on the energy transition have been selected and experts were invited to bring to the floor their views on the future energy infrastructure and the position that the building stock will take. In particular research institutes and the academic world were investigated to seek the present status of research and innovation in technologies that could support the energy transition and especially the building sector. Two IEA EBC Annexes were invited to present the status of their research project. The selected topics for this symposium are related to monitoring, data analysis and modelling, energy standards, the gap between design and real values of energy performance of buildings, renovation of the huge building stock and integration of renewable energy resources. Interesting questions were raised by the audience and discussed by the experts. Will a carbon free society be feasible using innovative technologies? Will the greenhouse gas emissions and final energy consumption be reduced while maintain the standards of living and working? Are the citizen aware and willing to pay? Will it be feasible to adjust the present building stock to the requirements set by the political targets of reducing GHG emissions? Are the variable energy resources like wind and solar power giving the security of energy supply?

In the transition towards a new energy system, based on minimal carbon use and circular economy principles, the building is the cornerstone of the future energy infrastructure. Energy use in European buildings is still around 40 % of the total final energy use. Decarbonisation of power and heat are high on the agenda of EU Member States. Present initiatives by governments for a proper energy transition are based on reducing energy consumption, increased use of renewable energy resources and making the energy infrastructure more intelligent (SRI as mentioned in the EPBD). Presently, the major part of final energy in buildings is heat. In the near future, this will be converted more from (renewable) electricity. The energy transition should be a play between governments, industry and end-users. Often not considered, the citizen should become at the centre of the energy system; from passive consumers to engaged energy customers. For that purpose digitisation is essential, enabling monitoring and control of optimised energy use for a comfortable living and working environment. The energy infrastructure needs to address the balancing for energy at different levels (TSO and DSO). The energy markets play an important role in managing the flows of energy in multi-directions. However the level of balancing between the building end-user and the climate is not often carefully considered. Also, the energy flow between buildings and the energy networks will become more and more bi-directional. Buildings will have to become flexible and produce energy: electricity that is partly delivered to the grid, and heat that is stored in the building or underground. The near future may see more self-consumption in buildings, including the electricity stored in electric cars. One may conclude that buildings in which presently 40% of final energy is consumed, will take a more prominent position in the energy infrastructure.

An extended summary can be downloaded from www.dynastee.info.

Thermporal: A Temporal Thermography System for Residential Energy Auditing

Matthew Louis Mauriello (Postdoctoral Scholar, Stanford University & Oregon State University)

Underperforming, degraded, and missing insulation is common in US residential buildings [15]. Detecting these issues, however, can be difficult. For example, when looking for insulation issues there is typically no visible indication of a problem on the finished surfaces of a building's envelope—the physical separator (i.e., composed of exterior walls, windows, etc.) between the conditioned interior of a building and the unconditioned environment outside it. While professional energy audits are effective at locating these insulation issues, these services are not widely used by homeowners due to their cost and a lack of awareness about their need or availability [16,17]. Additionally, tools and techniques such as thermography that help reveal issues (e.g., insulation problems, poor window sealing) have previously been inaccessible to homeowners. Today, improvements to and falling costs of infrared sensing technologies are beginning to fundamentally change who has access to thermal cameras [1,11] and has led to their increased use in energy audits by both professional and novice energy auditors [2,4,8]. However, using a thermal camera and determining if a thermogram shows a problem requires training and experience [9,10,12,13].

To explore how temporal thermography may address challenges related to both professional and novice energy auditing activities and interactions, I present an easy-to-deploy, temporal thermographic sensor system called Thermporal (Figure 1) designed to support residential energy audits by employing quantitative analysis techniques from building science literature and applying them to thermal imagery from multiple time-series captures [6,14]. The system was designed to be easily operated by offloading calibration of the system to a suite of sensors, several image processing techniques (e.g., [3]), and just a little of input from the user. Once calibrated, the system will perform an overnight scan of a user-selected region-of-interest and when that completes the system provides users a semi-customizable report in the form of an infographic that contains: (i) analysis, (ii) relevant tips about repairs or other environmental issues, and (ii) interactive graphics of the collected sensor data.

In the proceedings of ACM'S CHI 2019 Conference on Human Factors in Computing Systems (https://chi2019.acm.org/) this May, I will present the culmination of my dissertation research featuring the final evaluation of Thermporal that discuss two studies: (i) a one-week, in-home field study in five homes and (ii) a semi-structured interview study with five professional energy auditors. Results show that Thermporal helps raise awareness, improves homeowners' ability to gauge the severity of issues, and provides opportunities for new interactions between homeowners, building data, and professional auditors. I hope you will join us!

In the future, I plan to make open source instructions and code available for DIY energy auditing and other "maker" communities to help me tinker with and improve the system. With community involvement, I hope to explore (i) how the physical system might be redesigned to be more modular (e.g., allowing for different cameras and sensors to be swapped in similar to other auditing kits [5,7]), (ii) how the capabilities might be expanded to fill roles outside of residential audits, and (iii) how to improve the system such that it will perform well across building types and environmental conditions.

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Figure 1: Our temporal thermographic sensor system, Thermporal, is designed to collect and store all the data necessary for performing quantitative analysis of insulation performance and includes: a FLIROne thermal camera, environmental sensors, and a Wi-Fi connection for accessing weather data; users primarily interact with the system using a touchscreen display.

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12th Nordic Symposium on Building Physics, 14-17 June 2020, in Tallinn, Estonia

This Building Physics conference has been organized in the Nordic countries every third year since 1987. The conference is not limited to cold climate but has grown to attract participants from all over the world. It is the biggest and longest international conference in building physics attracting both scientists and practitioners. NSB 2020 Tallinn team lead by Jarek Kurnitski and Targo Kalamees warmly welcomes DYNASTEE and Annex 71 network to attend the conference. See also events on the web-site www.dynastee.info

Abstract submission is open until September 30, 2019.

More information about the venue, registration and important dates: https://nsb2020.org/.

The conference focuses on the heat, air and moisture transfer in buildings, and on aspects in microbiology, building services and energy performance linked or strongly interacting with building physics. There are four themes (see topics from webpage):

- Building envelope systems
- Fundamentals and modelling techniques
- Integrated aspects of building physics
- Moisture safety, mould and dampness

The conference papers are divided into two categories: scientific Scopus conference papers and technical papers. The scientific papers have the suggested length of 6-8 pages while the technical ones can be 2-6 pages. The technical papers should be used for case studies, project introductions, and other practical questions. These do not have to apply scientific methods.

Tallinn, Estonia

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 items. 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 grouping profiled itself as a scientific community of experts on Testing, Analysis and Modelling. In 1998, PASLINK EEIG started a new project PV-HYBRID-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), focussing on quality assurance in testing andanalysis under outdoor test conditions as well as evaluation techniques of collected in-situ data. The expertise of the grouping 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 recently the new project IEA-EBC Annex 71 'Building energy performance assessment based on in-situ measurements'.