DYNASTEE

NEWSLETTER ISSUE 2017/9

Foreword

DYNASTEE continues to disseminate information on dynamic assessment methods for the energy performance of buildings. This newsletter is an introduction to more in depth information, articles on new approaches and methods, the progress of works in the Annex 71 project of IEA, past and future training sessions, and the website http://dynastee.info where you may find all results from the past and the most recent information and details.

In the near future, DYNASTEE will develop an advanced training school (first session in Almeria, September 2018) as well as an on-line version of the basic training course as was given in the 6 Summer Schools in previous years. New actions include workshops, doctoral colloquia and a network of excellence. We will keep you posted on new developments and events.

The actions of DYNASTEE are since November 2017 co-ordinated through an enlarged steering group and is composed of:

Hans Bloem, INIVE

Luk Vandaele. INIVE

Maria José Jiménez, PSA CIEMAT

Paul Strachan. ESRU Strathclyde

Matthias Kersken. Fraunhofer

Henrik Madsen/Peder Bacher, DTU

Alex Marshall, Salford University

Staf Roels, KULeuven

View on the South end of the CE1 test case building

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- Alex Marshall, Salford University

Announcement of the Summer School 2018 - 10 - 14 September, Almeria, Spain

Level 2: "Dynamic Methods for whole Building Energy Assessment"

After 6 very successful editions of the Summer School on *"Dynamic methods for whole building energy assessment"* this time a more advanced level is introduced focusing on the variability aspects of boundary conditions. Pragmatic solutions will be applied to assess thermal characteristics of buildings, based on the material used for the Summer Schools but more advanced in dealing with building physical aspects as well as more complex mathematical and statistical techniques. Specifically the focus will be on:

- Variable climate data from solar radiation and wind
- Analysis problems due to not-measured phenomena
- Whole building energy analysis and model simplification using LORD
- Working in continuous time with CTSM in the R environment.

Exercises will deal with benchmark data that brings the forementioned complexity to the front.

When and where?

The venue for the Summer School is in Almeria, Spain and takes place from Monday 10 until Friday 14 September, 2018.

Detailed information about the presented topics can be found in the announcement that comes available early 2018. The cost for the week-long Summer School is 450 Euro.

Registration for the Summer School will be possible as from March 2018 www.dynastee.info

Objective

The main purpose of this summer school is to train a methodology for evaluation of measured data. Enthusiastic lecturers will teach methodologies in more than 10 presentations for assessing the heat transfer characteristics of building envelopes as well as whole building using data for hands-on exercises. During the summer course, information on relevant software will be given and software tools will be used in the exercises.

IEA-EBC Annex 71 Common Exercise 1: Exploring identification and characterization techniques

Glenn Reynders (EnergyVille/KU Leuven, Belgium), Geert Bauwens (KU Leuven, Belgium), Staf Roels (KU Leuven, Belgium), Dirk Saelens (EnergyVille/KU Leuven, Belgium), Chris Gorse (Leeds Beckett University, UK)

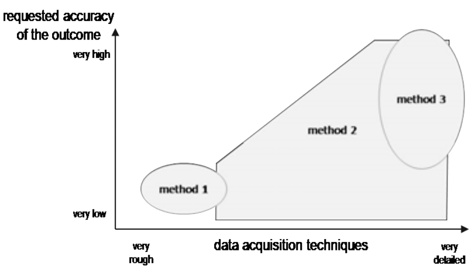
To increase knowledge and stimulate collaboration between participants, Annex 71 puts a strong emphasis on working with common exercises. A first common exercise was launched prior to the 3rd expert meeting in Chambéry and was deemed as a big success with contributions from 12 different institutes covering 6 countries and more importantly analysis of more than 15 different methodologies.

The goal of this common exercise was to explore the reliability of any identification technique participants are familiar with, making use of different combinations of measurements for a common case study. For example, in order to evaluate the impact on the obtained accuracy, participants were free to reduce the amount of input data, to aggregate data, use a shorter time span, neglect information... Hence, this first common exercise was very open and flexible. No methods were prescribed and no limitations were introduced regarding the use of the available data.

The data for the case study was made available by the University of Lincoln and covers a 3 year monitoring campaign in an end-terrace dwelling of four social houses in Gainsborough, UK. See the picture on the frontpage. The buildings are constructed to be highly energy efficient meeting the Level 5 Code for Sustainable homes. The data show, amongst others, indoor temperatures, gas and electricity consumption and climate data for the occupied buildings. A detailed description is available in [1].

The outcome of the common exercise was not expected to be the most accurate prediction of the dynamic behaviour of the building nor the most precise estimation of physical parameters. More importantly, the outcome of the common exercise should initiate the development of a matrix that links the model accuracy expected for a specific application to a list of required measurements and a statistical method.

The figure below presents the basic idea of the matrix. Starting from a required level of accuracy (y-axis), a certain method and corresponding measurement accuracy/data acquisition technique (x-axis) can be determined. Or, the other way around, knowing the data acquisition technique (variety and accuracy of the available data) the most interesting method and maximum attainable level of accuracy of the outcome can be determined.



Schematic representation of the characterisation method matrix

This matrix should help our stakeholders set up reliable experiments by extending automation and smart grid sensors, and by choosing the right level of detail and measurement accuracy needed to achieve the desired level of outcome. As such, this common exercise, as future common exercises in the Annex-project, links the different subtasks by combining statistical methods (ST2 and ST3) with the required level of data collection (ST1) and expected outcome (ST4).

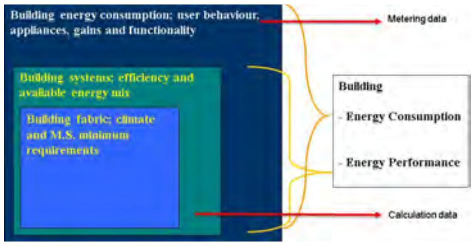
[1] Sodagar B and Starkey D, 2016. The monitored performance of four social houses certified to the Code for Sustainable Homes Level 5. Energy and Buildings 110: 245-256

In-situ Measurements and Standardization (CEN, ISO)

Hans Bloem, INIVE

The Energy Performance of Buildings Directive (EPBD) mentions in article 2 that the performance assessment can be made by calculation (for the purpose of building design) or measurement (dealing with renovation of existing buildings) and should be based on a concise methodology.

In situ measurements are, by definition, unique and involve dynamic boundary conditions (not necessarily steady-state). To be more precise, in situ measurements are carried out at experimental test facilities, specific test houses or well-controlled real buildings or dwellings and hence are unique experiments for a given location and test object. The test object could be a whole building, a part of it (building unit) or a building element. Presently no standard is available that adequately deals with in situ test methods (measurements) of construction products, building elements or building structures. Traditional test methods do not adequately characterize the performance of certain building products as they are intended to be used.



Relation of energy consumption and energy performance of a building

CEN/TC 371 is responsible for the overall consistency and horizontal harmonization of the set of EPB standards. This includes the preparation and maintenance of overarching EPB standards and other EPB framework documents and the management of the overall consistency as well as other common quality and usability aspects of the subseries of EPB standards that are developed and maintained by other CEN Technical Committees.

Discussions on a potential standard for in situ measurements of building insulation products have been centred in the Working Group 13, under Technical Committee 89 of the European Committee for Standardization (CEN).

CEN/TC 371 closely collaborates with ISO: an increasing part of the set of EPB standards is developed and maintained under the Vienna Agreement in collaboration with ISO, in particular with ISO/TC163/WG4, Energy performance of buildings using holistic approach, the Joint Working group of ISO/TC 163 Thermal performance and energy use in the built environment and ISO/TC 205 Building environment design.

A clear distinction (see figure on top) has to be made between building energy needs, building energy systems that are needed to fulfill the requirements of the building energy needs and energy consumption, corresponding to the end-user demand for working and living in the building in a comfortable way. Note that the EPBD defines energy usage for: heating, cooling, ventilation, domestic hot water and light and therefore the user energy consumption part that covers energy use of appliances, communication (TV, computer, internet) and others is not considered under the EPBD.

Two selected abstracts

1.Experimental assessment of room occupancy patterns in an office building.

Comparison of different approaches based on CO2 concentrations and computer power consumption.

J.A. Díaz, M.J. Jiménez, CIEMAT, Spain

Abstract

This paper reports on various options for estimating room occupancy levels in an office building from the results of testing, and aims to find an efficient way to represent this occupancy, optimizing accuracy, cost effectiveness and the intrusiveness of measuring, which is very useful for commercial applications.

CO2 concentration and computer electricity consumption were considered alternative indicators of occupancy level. Advantages and drawbacks of both indicators are discussed.

In both cases, ranges when the room was positively empty and when it was positively occupied were identified. This study is based on histograms that represent indicator measurements in each of those ranges during the study period. Afterwards, the ranges identified were used to find room occupancy patterns. Information previously available about the rooms, such as typical work hours, and lunch hours, holidays, weekends, etc., when rooms are empty were used to validate the results.

Data were from a seven-year series acquired while the building was in regular use. The first analysis considers all of these available data making results robust. Accuracy with shorter experimental test periods was also studied.

Ref erence

Applied Energy. 199 (2017), pp. 121–141. http://dx.doi.org/10.1016/j.apenergy.2017.04.082

2.The staged retrofit of a solid wall property under controlled conditions

Swan, W., Fitton, R., Gorse, C., Farmer, D. and Benjaber, M., 2017. The staged retrofit of a solid wall property under controlled conditions. Energy and Buildings, 156, pp.250-257.

Abstract

Retrofit of hard to treat properties has been highlighted as a policy challenge to reduce energy consumption in the UK. This study undertook an experimental staged retrofit of a pre-1919 UK solid wall property under controlled conditions. The property is housed within an environmental chamber, where the conditions were held at a constant 5 ◦C during the test to reflect UK average winter temperature, with all other boundary conditions removed. The retrofit was undertaken using commercially available products and at each stage a number tests were conducted to evaluate the performance, with the results for the coheating tests and in situ U values being reported here. The results show that the deep retrofit undertaken led to a 63% reduction of heat loss from the building, with the technical feasibility of staged retrofit clearly demonstrated from a heating energy efficiency perspective. The calculation of cost savings suggests that a whole house deep retrofit may not be financially feasible if supported only by energy savings. The use of controlled conditions did allow each stage to be measured and compared in a way that has not been achieved in the field, allowing for effective comparison of each stage previously only fully explored in models. There are limitations of the methodology driven by the lack of boundary conditions, specifically around air movement and longer-term performance issues, which are best addressed in the field.

Most recent works from the Salford Energy House Team:

Pelsmakers, S., Fitton, R., Biddulph, P., Swan, W., Croxford, B., Stamp, S., Calboli, F.C.F., Shipworth, D., Lowe, R. and Elwell, C.A., 2017. Heat-flow variability of suspended timber ground floors: Implications for in-situ heat-flux measuring. Energy and Buildings, 138, pp.396-405.

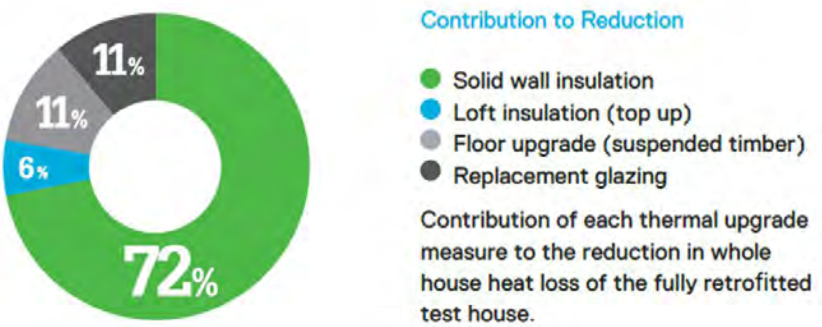
Marshall, A., Fitton, R., Swan, W., Farmer, D., Johnston, D., Benjaber, M. and Ji, Y., 2017. Domestic building fabric performance: Closing the gap between the in situ measured and modelled performance. Energy and Buildings.

Fitton, R., Swan, W., Hughes, T. and Benjaber, M., 2017. The thermal performance of window coverings in a whole house test facility with single-glazed sash windows. Energy Efficiency, pp.1-13.

Fitton, R., Swan, W., Hughes, T., Benjaber, M. and Todd, S., 2016. Assessing the performance of domestic heating controls in a whole house test facility. Building Services Engineering Research and Technology, 37(5), pp.539-554.

Swan, W., Fitton, R., Smith, L., Abbott, C. and Smith, L., 2017. Adoption of sustainable retrofit in UK social housing 2010–2015. International Journal of Building Pathology and Adaptation, (just-accepted), pp.00-00.

McLean, S. and Fitton, R., 2017. Smart surveys: A review of available technologies. Journal of Building Survey, Appraisal & Valuation, 6(1), pp.67-77.



External Wall Insulation applied to the Energy House Test Facility during a staged retrofit (L), Contributions of each retrofit measure to the overall heat loss reduction (R).

Outcome of the Summer School 2017 in Granada, Spain

A warm welcome to the participants by Josemaría Manzano Jurado, director of School of Architect from the University of Granada (founded in 1531) and Delfina Bastos González, academic secretary of the School was followed by a tour in the beautiful renovated old building in the centre of the city.

After 5 very successful editions of the Summer School on “Dynamic methods for whole building energy assessment” this time the focus was on pragmatic application of these dynamic calculation techniques. The main purpose of this summer school was to train a methodology for the evaluation of measured data. Five enthusiastic lecturers presented methodologies in more than 10 presentations for assessing the heat transfer characteristics of building envelopes using data for hands-on exercises. During the summer course, information on relevant software was given; for the practical exercises the software tool LORD was been applied on benchmark data as well as routines in the R-environment. More than half of the participants submitted prior to the course their homework which revealed that most of them have problems with assessing the thermal capacitance. This was the reason for a special lecture on how to deal with techniques for separating the static aspects from the dynamics. A more advanced course as a follow-up of this Summer School has been discussed, and may take place during the summer of 2018.

For the social mid-week event, a visit to the Salobreña Castle on the Mediterranean coast was organised followed by a dinner with all participants and lecturers on the terrace of a typical Spanish taberna.

Participants Summer School 2017, Granada

IEA EBC Annex 71 (2016-2019)

Building Energy Performance Assessment Based on In-situ Measurements

A better prediction, characterization and quality assurance of the actual building energy performance is essential to realise the world wide intended energy reduction in building communities and systems. Quantifying the actual performance of buildings can only be effectively realised by optimized in-situ measurements combined with dynamic data analysis techniques. The IEA EBC Annex 58 project made a lot of progress in this field. The current project Annex 71, aims to make the step towards monitoring in-use buildings to obtain reliable quality checks of daily building construction practice to guarantee that designed performances are obtained on site. More information can be found in the Annex 71 Factsheet.

http://www.iea-ebc.org/fileadmin/user_upload/docs/Facts/EBC_Annex_71_Factsheet.pdf

DYNASTEE is involved again in this project, taking care of dissemination by means of newsletters and the web-site. In addition it organises training through workshops and Summer Schools.

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-HYBRI-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'.