

DYNASTEE

DYNAMIC Analysis, Simulation and Testing
applied to the Energy and Environmental
performance of buildings

Free On-line Training Webinars | 2-9-16-23-30 September 2020

Dynamic Calculation Methods for Building Energy Performance Assessment

Technical
University of
Denmark



University of
Salford
MANCHESTER



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Panelists



Luk Vandaele (INIVE/Dynastee, BE)



Aitor Erkoreka (UPV-EHU, ES)



Richard Fitton (Salford University, UK)



María José Jiménez (CIEMAT, ES)



Hans Bloem (INIVE/Dynastee, BE)



Peder Bacher (DTU, Lyngby, DK)



Paul Baker (GCU, UK)



Irati Uriarte (UPV-EHU, Bilbao, ES)

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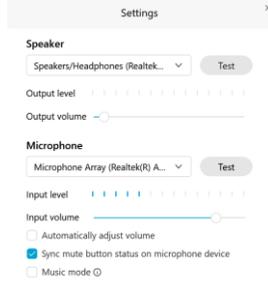
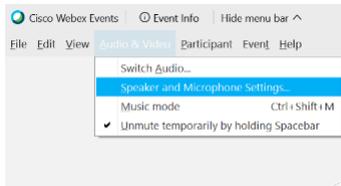
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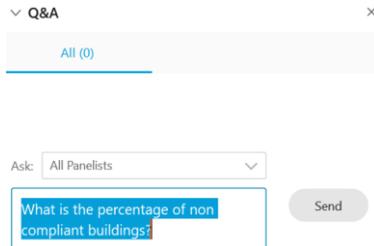
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How to ask questions during the webinar

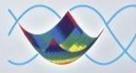
Locate the Q&A box

Select All Panelists | Type your question | Click on Send



Note: Please DO NOT use the chat box to ask your questions!

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Free On-line Training Webinars | 2-9-16-23-30 September 2020

Organized by <https://dynastee.info/>

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NOTES:

- The webinar will be recorded and published at <https://dynastee.info/> within a couple of weeks, along with the presentation slides.

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WEBINARS 2020 30 September 10:00 – 12:00

Dynamic Calculation Methods for Building Energy Performance Assessment

Technical
University of
Denmark



University of
Salford
MANCHESTER



presented by DYNASTEE-INIVE, CIEMAT, DTU, University of Bilbao, GCU, University of Salford



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TOPICS

- Building physics to support the development of mathematical models for energy performance assessment.
- Knowledge of thermodynamic processes, heat transfer and the impact of solar radiation.
- Thermal conduction, convection and radiation as well as thermal mass.
- Complexity of the physical process and how to translate the available information in mathematical models,
- Importance of model simplification of building physics represented by measured signals.
- Variability of the environments and the uncertainty of data
- Measured data and not-measured phenomena and how to build a mathematical model based on the available input.
- Using benchmark data-series for analysis

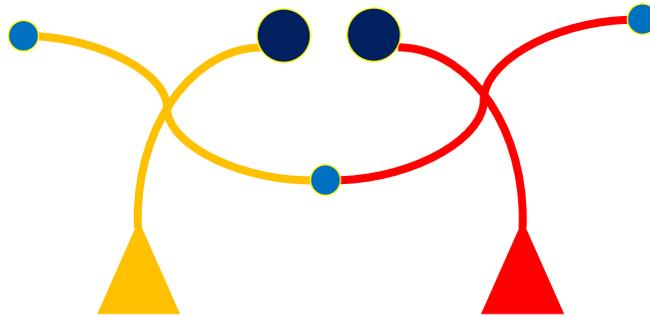
ANALYSIS

INPUT	METHODOLOGY	OUTPUT
Many observations from time and space ; raw data Physical processes Literature General knowledge	Description of physical processes into mathematical equations. Method should fulfil the aim taking into account the searched output	Limited value(s) Period; annual, daily, hourly Performance Efficiency; reference value Data for simulation
Pre-processing, Model choice Iteration process, Post-processing Statistical tests, Model validation External tests		

How to derive valuable results from many observations ?

WORKING TOGETHER

Building Physicist meets Statistician



That works well but

CONCLUSION

“One needs a certain level of skill to perform well”

- Improve knowledge through Training and Competition or visiting the Summer School in Almeria, June 2021.
- After 25 years DYNASTEE states:

Training make sense

TWO METHODS

Two perspectives will be discussed and applied using two approaches on benchmark data

- LORD; lumped parameter models
- CTSM-R; continuous time models
- See extended description; document [Software techniques applied to thermal performance characteristics](#)

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BENCHMARK DATA

- Simulated data homogenous wall
- In-Situ data from homogenous wall
- In-Situ data from composition wall
- Data from Round Robin box (research)
- In-Situ data from an air gap envelop
- Data from a whole building
- Data from a co-heating site experiment

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SIMULATED DATA

- BESIM20.pdf
 - Description of two benchmark cases
 - Based on simulated data, including noise
- Defstatest.pdf
 - Description of physical definitions and statistical tests

Data has been made available on:

dynastee.info/data-analysis/on-line-training

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Round Robin Box DATA

- PSA-RRbox_Dataserries20.zip
 - Three periods with different heating scheme
 - Volume – Surface ; six walls including one window
- SS20_RRbox_Instruction_document.pdf
 - Description of RRbox, sensors instruments and collected data

Data has been made available on:

dynastee.info/data-analysis/on-line-training

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Round Robin Box DATA

- PSA-RRbox_Dataserie20.zip
 - Three periods with different heating scheme
 - PSA16, ROLBS
 - PSA17, Co-heating
 - PSA18, Low-setpoint heating
 - Stepwise increase of complexity;
 - start with thermal resistance of the rear wall (no impact from solar radiation). Then ceiling and floor.
 - Volume – Surface ; Siviour analysis.
 - Assessment of Heat Loss Coefficient

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IN-SITU WALL DATA

- In_Situ_ExerciseWall_20s.pdf
 - Description of the in-situ wall measurement
 - Two periods of data; shaded and not shaded; average of five sensors
- In_Situ_GFwall20s.pdf
 - Description of the experimental setup and data

Data has been made available on:

dynamstee.info/data-analysis/on-line-training

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QUESTIONS

To Organisers

- Please could I have access to the LORD software
- The Summer School has been postponed to June 2021, can you please clarify this?
- Also, will the participants receive ECTS credits?

- How to estimate the C value of the wall.
- I am interested in the article on ROLBS and the PRBS

- The Brazilian timing zone is GMT+2 and the Dynastee classes start at 5:00 in Brazil; if there is any possibility of attending the Dynastee classes at another time

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QUESTIONS

Questions for Aitor Erkoreka:

- **Q1:** Realistically, how precise can you expect to model a real building?
- **Q2:** How do you choose the position of the sensors (Temperature, CO2...)
- **Q3:** If the heat transfer through thermal bridging can be 50% of total transmission heat losses, why are these ignored?
- **Q4:** Are there sensors that calculate the thermal comfort levels of a building (according to a specific model), or we have to calculate it by collecting its parameters?

Questions for Irati Uriarte

- **Q1:** What does medium mean in the model formulation? How is it different from the interior?
- **Q2:** Why is the weighting parameter needed in the simulation? Can different persons get the same results for the weighting parameter?

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QUESTIONS

- **Q3:** Why reduce the dataset to 3 days ? Would the results be 'safer' if the whole dataset was used (by minutes over 1 month) ?
- **Q4:** Will we have the presentation?
- **Q5:** How about the dataset for the study?

Questions for Peder Bacher:

- **Q1:** Is the statistical model applicable on large datasets with a big number of input variables?
- **Q2:** Is it a good idea to aggregate them to monthly data? Does the error increase depending on that the data are hourly, daily or monthly?
- **Q3:** Will we get the R scripts along with the slides ?
- **Q4:** Does the model work on other data rather than temperature data?
- **Q5:** Regarding the temperature data, is it hourly, daily or monthly temperature data? Supposing I have daily data, is it a good idea to aggregate them to monthly data?

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QUESTIONS

- **Q6:** What could be the magnitude of noise? What value can show that the noise (or residuals) is big to not validate the results?
- **Q7:** Would you ever be able to correlate those estimated parameters with physical aspects of the building itself?

Other questions

- I am interested in the automation of model order selection (e.g. in ARX models), what would be a good approach? In which order to use the model validation techniques? In other words, how to say a model is satisfactory without looking at the plots ourselves (and let the computer do it for us)?
- How to interpret/incorporate : Model errors, sensor data errors, manufacturer errors and uncertainty due to physical variables i.e solar, in the analysis?
- Which one is significant to mention in a report ?

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QUESTIONS

- When dealing with real data (real-life occupied homes), there are **unknown** parameters such as : Solar gains, Metabolic/internal gains, infiltration/ventilation, Ach or hot water use, can the uncertainties be quantified/estimated ? if yes, how?
or are they pre-defined i.e. in Annex 58 & 71 ?
- At what point do we decide that a dataset is 'useless' and not to be used due to ACF , CP gram behaviour, in other words most real-life datasets would probably fail these tests, or how do we report errors and uncertainties of bad results?
- Can a linear model such as ARX model or Energy Signature model be used to **compare two different sized properties** in terms of heating energy demand for space heating?
i.e. by comparing both regression models T_i coefficients?

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SUMMER SCHOOL 2021

Dynamic Analysis Techniques for Building
Energy Performance Assessment

Contact : mjimenez@psa.es



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SUMMER SCHOOL 2021

Dynamic Calculation Methods for Building Energy Performance Assessment

Facts

- When: 16 – 23 June, 2021
- Where: Almeria, Spain
 - near the Mediterranean coast
 - Information on the DYNASTEE web-site
- Why ?
 - Progress is made and advanced level is requested
 - More study on impact of solar radiation and wind
- Who?
 - all having interest in application of *Dynamic Calculation Methods for Building Energy Performance Assessment*



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SUMMER SCHOOL 2021

Dynamic Calculation Methods for Building Energy Performance Assessment

Proposed program

- When: 16 – 23 June, 2021
 - Start: Wednesday 16 June 13:00
 - Weekend break
 - End: Wednesday 23 June 13:00
- Part 1 : LORD and discrete time models
- Part 2 : CTSM-R and continuous time models
 - Progress is made and advanced level is requested
 - More study on impact of solar radiation and wind
 - Follow us on www.dynastee.info

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https://dynastee.info/data-analysis/on-line-training/

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Home--Data Analysis--On-line Training

On-line Training

During Spring 2020 the DYNASTEE board has decided that it will support on-line training. It will do so by organising a series of webinars during September 2020 on each Wednesday from 10:00 to 12:00. Each webinar will be composed of two lectures and introduce an exercise using benchmark data that will be made available to the participants for training.

The proposed on-line training concerns the application of *Dynamic Calculation Methods for Building Energy Performance Assessment*. The proposed program for the webinars can be found [Program_OnLineTraining20s](#).

Note that these webinars cannot be compared with the traditional and physical Summer School that DYNASTEE has organised for the last 8 years, where a close interaction between lecturers and participants is taking place. The webinars should be considered as a helping hand to get started with *Dynamic Calculation Methods for Building Energy Performance Assessment*.

To get an impression of what these webinars are about, a recent extensive **paper** presenting the data analysis process applied to high quality data from an outdoor experiment can be downloaded for free ([DynamicAnalysisApplied2EPB](#)). Also during the webinars, reference is made to benchmark data that DYNASTEE has made available.

The first data-series are simulated data and can be found here [BenchmarkTestDynMethods20](#). The zipped folder includes the following files: *Dataseries* in text format and *Besim20.pdf* (document describing two cases for self-training) and *defstatest.pdf* (document that contains definitions and statistical tests).

The second data-series are real experimental data from a Round Robin testbox. Minutely data of 45 sensors are made available for about a month divided into three **separate periods**, each with its particular heating regime. The data make it possible to **perform different analysis of walls, windows and space**. These data-series can be found in the zipped folder *PSA_RRBox_DataSeries20* and contains three data-series (*Almeria_series16* to 18) and the **documentation** *SS20_RRBox_Instruction_document.pdf* (describing the experimental setup).

In addition, two extensive documents dealing with data analysis, have been made available from the IEA-EBC Annex 58 project (2011 – 2016):

Highlights

- On-line Training Webinars
- DYNASTEE newsletter issue 2020/16 now available
- DYNASTEE newsletter issue 2020/15 now available
- DYNASTEE newsletter issue 2019/14 now available

About DYNASTEE

DYNASTEE stands for: "DYNAMIC Analysis, Simulation and Testing applied to the Energy and Environmental performance of buildings". DYNASTEE is an informal grouping of organizations actively involved in the application of tools and methodologies relative to this field. DYNASTEE functions under the auspices of the INIVE EEG and constitutes a sustainable informal networking mechanism, which is intended for those who are involved in research and applications for the assessment of energy performance of buildings in relation to the Energy Performance for Buildings Directive (EPBD).