



ROUNDTABLE DISCUSSION — part 3	between Joe Clarke, John Grunewald, Per Sahlin, Michael Wetter, Andrew Corney & Lori McElroy at BauSIM 2020, chaired by Christina Hopfe
SOFTWARE NEWS	from CityFFD, Cove.tools, Lumo, Climate.Onebuilding.org, EWE & DesignBuilder
CALENDAR OF EVENTS	14 conferences for your diary
plus	Ask A Modeler Q&A, a feature article on a global building occupant behaviour database, a Call for Proposals for Building Simulation 2025, news from IBPSA-Brazil, IBPSA-England, IBPSA-India and new affiliate IBPSA-Iran, and a list of recent papers in JBPS

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The International Building Performance Simulation Association exists to advance and promote the science of building performance simulation in order to improve the design, construction, operation and maintenance of new and existing buildings worldwide.

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### President's message

Dear IBPSA Colleagues and Friends

I hope that this finds you and your loved ones safe and well. I was hoping that by now we would all have had the chance to travel and meet up with friends and colleagues, but progress is slower than expected, as the virus continues to evolve. Hopefully as vaccination programmes roll out we will continue on a path that takes us, albeit slowly, in the right direction, although as I write I do realise that the situation varies from country to country and region to region.

It seems that we have lurched from one crisis to the next over the last few years, and despite reduced global travel we make little progress on emissions reductions. As fuel costs, and as a result living costs, escalate it was never a better time to look at the role of building performance simulation in helping to minimise the impacts of these emissions in both warmer and colder climate zones.

We are heading fast towards the IBPSA Board Elections, which will take place in June and July. We will shortly be calling for IBPSA members to put themselves forward for election to the Board and we would welcome applications from members who represent Affiliates that are under-represented at Board level. I anticipate that the call will go out at the start of May with a closing date in the middle of May. In addition, I would draw your attention to the article in this newsletter, calling for people to join our recently formed Equality, Diversity and Inclusion Committee. This will be a busy committee as this is an area that we have not tackled formally in the past – on the basis that inclusivity is inherent in what we do – but reality and perception can be very different things and we need to test and formalise this. The committee is currently small, with much to do, so please do consider joining. More details on page 39.

Work on our next Building Simulation Conference (BS2023) is stepping up and it is expected that we will have a chance to convene in Shanghai on 4-6 September, currently planned as an in person event – so something to look forward to in our calendars. Please watch out for announcements and calls for papers.

One positive from the pandemic has been a heightened awareness of the quality of and importance of outdoor spaces, from intermodal transport to smart grids to accessible greenspaces. This has rekindled interest in simulation of the urban environment and as a result we are looking for papers for a special issue of the Journal of Building Performance Simulation. The closing date for expressions of interest is 30 April 2022. More details on

page 51.

As we head into Spring in my part of the world, everything is coming to life – but I am aware that there are places where life can be much more difficult. I hope that there are better times ahead for everyone. My thoughts are with you all.

Stay safe

Lori McElroy President IBPSA

holi By

# Best of 'Ask a Modeler': Scaling Up Simulation

'Ask a Modeler' is an advice column for the building simulation community through which we hope to expand communication and create a sense of community among practitioners, researchers, and academics at all points in their building simulation careers. Each month, the Emerging Simulation Technology subcommittee poses a question submitted by an IBPSA member to recognized building professionals to get their expert perspectives. Below, we are reprinting some expert advice from the past few months; you can read our past columns at https://www.ibpsa.us/category/aam/. We hope that sharing these questions and insights will bring value to your work and possibly make you think about building performance modeling from a new point of view.

You can submit your questions at **askamodeler@ibpsa.us**. Note that any requiring an immediate response should be submitted to the community of experts at unmethours.com. If you are interested in replying to a question as a featured expert or have any other feedback about Ask a Modeler, please email **askamodeler@ibpsa.us**.

### What data sources can you use to do modeling at the urban scale and beyond?

- Bigger and Better

### Dear Bigger and Better,

When modeling individual buildings, obtaining pertinent data about the building that impacts its energy use is straightforward. You can observe physical traits of the building such as footprint, height, and number of floors, and you can obtain characteristics related to the building's energy performance such as HVAC type, schedule, and water use with an energy audit. These building properties can be aggregated and used as inputs to a physical building simulation engine (such as EnergyPlus) to develop a building energy model that, with some tuning, may be representative of the building.



While it is possible to collect this amount of data about individual buildings, it becomes more challenging to collect this data or complete energy audits on thousands or millions of buildings when doing urban, utility, or nation scale analyses. For this reason, large scale building energy modeling analyses often simplify the required input data to four variables from which all other building properties may be derived (though more specific data about a building may be used if available). These properties are building footprint, height, type, and age. From these properties, all other information about the building may be assumed. For example, the building type informs the floor-to-floor height which can be used with the height to estimate the number of floors (or the number of floors can be used directly if that data is available). The building type also informs the windowto-wall ratio, HVAC type, schedules, etc., while the age of the building informs characteristics such as insulation and infiltration. Even though the properties assigned to an individual building may not match perfectly as not all buildings are the same, the aggregation of all buildings of that type and age should be representative.

Obtaining this building data at urban, utility, and national scales comes at varying difficulty for each variable. The building footprint and height provide the physical structure of the building but not the performance. The building footprint has become easier to obtain at a large scale in recent years due to the proliferation of publicly available data in sources such as OpenStreetMap (https://www.openstreetmap.org), which provide more than 129 million building footprints for the United States. This footprint data is created using convolutional neural networks on overhead images with segmentation and polygonization applied to simplify the footprints (see https://github.com/microsoft/USBuildingFootprints). Building height data have proven to be a more difficult problem. Certain counties and regions have publicly available height data that is typically obtained using LiDAR or other localized methods. While expanding the scale at a high resolution creates challenges and uncertainty, a 30-meter resolution dataset called "AW3D30" (see https://ui.adsabs.harvard.edu/abs/ 2016ISPAr41B4..157T/abstract) was released in 2016 and can provide a rough estimate of building height with proper manipulations. Unfortunately, resolution of height data is an important factor because at low resolutions, tall objects around the building may influence the height estimate. The United States Geological Survey (USGS) currently has a categorical mapping of US building heights (https://data.usgs.gov/datacatalog/data/ USGS:5775469ce4b07dd077c7088a), and while this cannot be used directly, they have been expanding their 3D elevation program and may soon make higher resolution data available.

The building type and age fill out the physical skeleton developed by the footprint and height. These factors have a huge influence on the energy use of each building. A misclassified building can result in an energy difference of more than 10x. At a small scale (city or county), building type can often be gathered from taxassessor's or parcel data. It can be difficult to aggregate parcel data at a multi-county scale due to the differences in the structure of each individual database. If working with a utility or if hourly measured energy use data is available, these building energy signatures can be compared to models of prototypes for each category of buildings to assess which category the individual building signature best fits. This method will provide the building type that is most representative of the energy use, but not necessarily the function as not all buildings of the same type use energy in the same way. At a national level, there are currently no aggregated building type datasets. For analyses of this scale, heuristics based on building physical attributes and the distribution of building types in that region can be used to classify buildings. While it is unlikely to classify every individual building properly, the hope is that the aggregated building type distribution is representative. Like building type, the year built may be available at a city or county level from tax-assessor or parcel data. New urbanization research has attempted to determine when a building was constructed by mapping global artificial impervious areas (GAIA) from a period of 1985 to 2018 (https://doi.org/10.1016/j.rse.2019.111510), which can be used to estimate the age of tens of millions of buildings.

As these data sources continue to expand and improve, the modeling capability and quality will follow, allowing researchers to better represent large quantities of buildings and identify how to reduce their negative carbon effect on the environment. This negative carbon effect can be achieved in a variety of ways once representative models are developed. Savings estimates from modeling building technologies/retrofits can be used to secure financing for implementing these technologies in order to produce real savings. Models can be aggregated and used by a utility to estimate peak demand, allowing them to optimize their grids and use the oldest, most costly, high emission energy generation capability as scarcely as possible. These are just two examples of the numerous ways building energy models can be used to lessen the negative carbon impact buildings have on the environment.

Brett Bass, PhD, R&D Associate Staff Member, Oak Ridge National Laboratory bassbc@ornl.gov

### What is TMYx and how does it differ from TMY3 weather data? Is there anything I should know about where this weather data comes from?

— April Showers

#### Dear April Showers,

The short answer is that TMYx is a new (albeit confusingly named) update to the TMY family of files (following TMY, TMY2, and TMY3). These files were not officially developed by NREL, as the TMYs were, although they were developed by some of the same people.

For some background, TMY3 is the third iteration of the most popular climate file format (after TMY and TMY2). TMY, standing for 'typical meteorological year' can be a file format in itself, though it most commonly refers to a methodology being used to create the files, which are most often stored in an EPW (EnergyPlus Weather) comma-separated value (CSV) file format. These three iterations of TMY files have been developed over the years by NREL and have



sequentially used more recent data, better data collection (and calculation) methods, and more and more weather stations. They are the most-commonly used in the United States (as that's where they were developed). However, several similar formats are used around the globe, as well as reference year files which simply choose a year within a set of measured data to be the most representative of the climate. The legend on the map of weather files at https:// www.ladybug.tools/epwmap/ will help you understand the various international climate files.

TMYx files contain typical meteorological data derived from hourly weather data through 2018 (soon to be through 2020) in the ISD (US NOAA's Integrated Surface Database) using the TMY/ISO 15927-4:2005 methodologies. Currently, there are more than 13,550 TMYx locations supplied. This is the dataset and methodology used in the creation of TMY3 files, although some stations may have been taken offline, and new ones added.

One major improvement is the use of the ERA5 satellite derived data set for solar radiation. Previously, the National Solar Radiation Database (NSRDB) was used, which covered most of the Americas but required solar radiation to be calculated for most of the rest of the world. With ERA5, all TMYx files contain data that is satellite derived, which is preferred over calculations that make assumptions based on other climate variables.

There are multiple options within the TMYx filesets. The default file, with a naming convention such as LUX\_LU\_ Luxembourg.AP.065900\_TMYx.epw, contains is derived from all available data up until 2018. (The number 065900 indicates a weather station where the data was measured.) The specific year range is defined in the 6th row of the file's header and often begins in 1947, especially for locations in the USA. Files with names such as LUX\_LU\_ Luxembourg.AP.065900\_TMYx.2004-2018.epw are explicit about the years used. These are the most useful, in this author's opinion, because they are derived from more recent weather and reflect some of the widespread impacts of climate change. Note that TMY style files intentionally remove extreme events, so the increase in rain, fires, and other storm events are not captured. There is research to create Extreme Meteorological Year files, which attempt to solve this issue, but there is not yet a universally accepted definition of this file format.

In the end, these files still retain the format of EPW files and can be used in all of the same simulation software or opened directly in a text editor or Excel (as a CSV). The **EnergyPlus documentation** is a good source for those interested in using the raw data.

To download the files and find some more information, I'd recommend visiting http://climate.onebuilding.org.

Ben Brannon, PE, BEMP, Senior Engineer, Arup

### A Global Building Occupant Behaviour Database

Bing Dong, Yapan Liu, Wei Mu, Syracuse University Tianzhen Hong, Lawrence Berkeley National Laboratory Bjarne Olesen, Technical University of Denmark Thomas Lawrence, University of Georgia Zheng O'Neill, Texas A&M University

### 1. Introduction

Building energy use is a systematic procedure comprehensively influenced by not only engineering technologies, but also cultural concept, occupant behavior and social equity. People spend nearly 90% of their lifetime in buildings, which makes occupant behavior one of the leading influences of energy consumption in buildings. Indeed, occupant actions such as adjusting a thermostat and opening/closing windows for thermal comfort, switching lights on/off and pulling window blinds up/down for visual comfort, using appliances, and moving between spaces can have a significant impact on both energy use and occupant comfort in buildings. Depending on the building type, climate, and degree of automation in operation and controls, such behaviors can increase or decrease energy use, for example, by a factor of up to three for residential buildings, and increase energy use by up to 80% or reduce energy use by up to 50% for single-occupancy offices, while having a 41% Heating, Ventilation, and Air Conditioning (HVAC) energy savings potential for office buildings. However, each research study has its own datasets and represents an individual case, although studies are across various countries globally. There are over 400+ papers published on the topic of occupant behavior over the last decade. Hence, it is time to consolidate those very valuable datasets into a large data repository. With such a large body of data to work on, occupant behavior researchers will be able to dive deeper to compare occupant behaviors across various building types and nations and derive valuable information for energy-efficient building design and operations.

Over the last decade, many research studies focused on the modeling and simulation of occupant behavior in buildings (e.g., IEA EBC Annex 53, Annex 66, and Annex 79), and their applications to building design and operation. Depending on the building types, climates, systems and controls, occupant behaviors could have favorable or adverse impacts on building performance. Thus, there is a need for a world-wide open-source database on occupant behavior in the built environment.

The ASHRAE Global Occupant Database we have developed includes 34 field-measured building occupant behavior datasets collected from 15 countries and 39 institutions across 10 climatic zones covering various building types in both commercial and residential sectors. This is a comprehensive global database of building occupant behavior. The database covers occupancy patterns (i.e., presence and people count), indoor and outdoor environment measurements, and occupant behaviors (i.e., interactions with devices, equipment, and technical systems in buildings). The database is open-access and provides data visualization, Application Programming Interface (API), and query tools. The database intends to support occupant behavior research that informs the design and operation of low or net-zero energy buildings with significant human-building interactions (HBI), and improve the understanding of human-building interactions, which is a key for design and operation of low-energy and high-performance buildings.

### 2. Technical Approaches

This project is organized into four approaches as shown in Figure 1, including data collection, data processing and quality control, building metadata modeling, and database development.



Figure 1. Overview of the technical approach

### Data collection

This project includes datasets contributed by researchers around the globe. To collect the most relevant data, the project team conducted a worldwide survey for researchers who are willing to contribute to the database. The survey contains some basic questions about the building metadata, zone information, building equipment, data collection method, dataset information, and additional information. With the information collected from the worldwide survey, the project team reached out to potential contributors with more detailed requirements. Below is a list of preliminary data requirements:

- Data that comes from field experiments, and represents "real" occupant behaviour in real buildings;
- The data collection period is at least one month to represent weekly and monthly behaviour patterns or any behaviour changes within buildings;
- Data on adaptive behaviour (e.g., opening or closing windows to maintain thermal comfort) provided with indoor and outdoor environmental parameters (e.g., ambient and indoor air temperature);
- The dataset should contain metadata information, a dictionary of data headings, experimental setup details, and data collection methods.

### Data processing and quality control

After receiving raw datasets from the contributors, each dataset was inspected based on the above requirements. The contributors were responsible for addressing privacy that relevant for occupant data and limited further anonymization was added as part of pre-processing. All datasets were then separated into Survey type, in-situ type, and mixed type of data. The in-situ data contains dynamic information and measurements in the building with constant sampling intervals, such as door and window status (OPEN/CLOSED), indoor equipment status (ON/OFF), indoor environment information (temperature, humidity, Carbon dioxide (CO2) concentration, illumination, etc.). Survey data contains unique information from the specific study, including occupant questionnaires, static information about the building envelope, and floor plan. Datasets without timestamps were also classified as Survey type data. And the mixed type of data contains both in-situ and Survey type of data, only one dataset was identified as mixed type. There are in total 34 datasets which include 24 in-situ types of datasets, one mixed type of dataset, and nine Survey type datasets.

### **Building metadata modeling**

In this database, each dataset contains one or more buildings with various types of sensors installed to measure occupant behavior patterns, indoor and outdoor conditions. The Brick schema was adopted to develop building metadata models, to better present the information of different types of measurements and relationships between subsystems with buildings. The database users can easily extract building metadata information (e.g., number of rooms in the building, number and types of sensors that were deployed in the space) without querying the database.

An extension to the Brick schema was proposed and implemented to describe the contextual, demographic, and behavioral information of occupants and their related data, including occupant information (i.e., occupancy,

attributes, attitudes) and occupant adaptive behaviors (i.e., adjusting thermostat, opening windows). The extension was built upon previous occupant ontology and schemas but adds significant new semantic representations in the Brick schema through an open source code at GitHub. The Brick extension includes four aspects, a new Occupant class, several new Point sub classes, several new Equipment sub classes, and new relations between Equipment class and Occupant class to represent human-building interactions, as illustrated in Figure 2.



Figure 2. Illustration of the Brick extension for Occupants

### Database development

The database was created and hosted via a publicly accessible website (https://ashraeobdatabase.com). One of the main features of the ASHRAE Global Occupant Behavior Database is the query builder. It allows users to select and download data from different studies, filtered by behavior types and multiple other criteria. The database also provides interactive data analytics, it generates a bar chart based on different user selections of building types, room types, and behavior types. Python APIs were developed for users to download data programmatically.

### 3. Outcomes

### **Database description**

Figure 3 shows the geographical and institutional details of the global contributions to this occupant behavior database. Köppen-Geiger climate classification has been widely used in the smart building area by researchers around the world. Since the datasets were contributed by researchers around the globe, Köppen-Geiger climate classification was adopted to represent the different climate zones in the datasets. The database covers 10 different climate zones globally according to the Köppen-Geiger climate classification (https://en.climate-data.org), which covers Tropical rainforest, Tropical savanna wet, Hot deserts, Humid subtropical, Temperate oceanic, Hot-summer Mediterranean, Cool-summer Mediterranean, Hot-summer humid continental, Warm-summer humid continental, Monsoon-influenced hot-summer humid continental climates.



Figure 3. Global Contributions to the ASHRAE Occupant Behavior Database

### **Brick model**

Among the collected datasets, 22 Brick models have been developed for the in-situ datasets to represent building metadata, each Brick model includes an output.ttl (Turtle) file and PDF file. The Turtle file, which is the Brick model that can be viewed interactively through the Brick server (https://viewer.brickschema.org). In the PDF file, users can get a glimpse of sensor measurement types and relationships with the building. Through the Turtle file, users can extract the complete building metadata information of the dataset without opening those datasets. Figure 4 shows an example of the Brick model for Dataset 20. The data contributor collected appliance usage, indoor and outdoor measurements from an educational office building in Vienna, Austria. Data collection started on January 1, 2013 and ended on December 31, 2013. The building has six different rooms, appliance usage data was collected from four out of six rooms, and indoor measurements were collected from all the rooms. This Brick model covers all the entities and their relationships in the dataset.



Figure 4. Illustration of the Brick model of Dataset 20

#### Database and available tools

A website (https://ashraeobdatabase.com) was created as a data warehouse for public access. Query builder tools were developed based on different behavior types, cities and countries, building types, study ID, and publication list. Users can select and download data from the database interactively with the query tools. Data analytic functions were developed to provide an interactive overview of the database and assist users to select the dataset. A Python package named "OBPlatform" was developed to access the database programmatically. The codes of this package are publicly accessible on the GitHub page (https://github.com/umonaca/obplatform) with beginner's tutorials. The website provides an API page that detailed out information to query and download datasets through Representational State Transfer (REST) APIs.

#### **Data exploration**

**Outdoor Measurements**. Field measurements of outdoor condition parameters were investigated based on the available datasets. Those outdoor measurements cover five different climate zones, such as Tropical savanna wet climate (Aw), Humid subtropical climate (Cfa), Temperate oceanic climate (Cfb), Monsoon-influenced hot-summer humid continental climate (Dwa), and Warm-summer humid continental climate (Dfb). Since datasets were collected from different months in various years, in order to compare outdoor measurements in the same time span, data from November of four datasets (5, 7, 14, and 16) were identified and analyzed. Hourly data from different datasets and plotted using boxplot. Figure 5 shows hourly outdoor temperature distributions of four different datasets and climate zones. Figure 6 shows hourly outdoor relative humidity distributions of those datasets. Figure 7 shows the hourly outdoor solar radiation distributions in datasets 5, 7, and 14 since dataset 16 doesn't measure outdoor solar radiation. The results captured different trends of temperature, relative humidity, and solar radiation within the four different climate zones by the time of the day.



*Figure 5. Outdoor air temperature distributions by hour in different datasets and climate zones. Dataset 16 – Aw;* Dataset 5 – Cfa; Dataset 7- Cfb; Dataset 14 – Dwa.



Hourly Outdoor Relative Humidity Distributions (November)

Figure 6. Outdoor relative humidity distributions by hour in different datasets and climate zones. Dataset 16 - Aw; Dataset 5 - Cfa; Dataset 7- Cfb; Dataset 14 - Dwa.



*Figure 7. Outdoor solar radiation distributions by hour in different datasets and climate zones. Dataset 5 – Cfa; Dataset 7- Cfb; Dataset 14 – Dwa.* 

**Occupant count historical data.** Figure 8 shows the historical data of occupant count in a commercial building from Dataset 32. The occupancy of two office rooms was measured from May 22, 2018 to July 11, 2018. From the figure, we can observe the weekday and weekend trends of occupant count in both rooms. Holiday effects can also

be observed, such as Memorial Day (Monday, May 28, 2018), and Independence Day (Wednesday, July 4, 2018). The occupant count dropped to relatively lower values during weekends and holidays. Figure 9 provides a detailed view of the historical occupant count in one week, a common workday schedule was observed from both rooms.



Figure 8. Historical occupant count data from Dataset 32



Dataset 32: Occupant Count in Commercial Office

Figure 9. Historical occupant count data from Dataset 32 in one week

### 4. Next Steps

The database will be maintained by the project PI Dr. Bing Dong and his research team at Syracuse University. Future work includes:

- Continuously promote this work in the research and industry community.
- Develop the approach of querying data through Brick building metadata models.
- Explore opportunities for Phase 2 of the ASHRAE Global Occupant Behavior Database, which will focus on maintenance of the database, and curating more datasets submitted by researchers over the time.
- Seek cooperation from industry partners to test this database and research different approaches to achieve energy savings.
- Promote and facilitate data analytics of the database to obtain better understandings of the occupant behavior data, and this can help with improving building design guidelines.

### Acknowledgments

We would like to acknowledge the sponsorship from the ASHRAE URP 1883 project, Building Technologies Office of the United States Department of Energy, and in-kind support from Annex 79 promoted by the International Energy Agency, Energy in Buildings and Communities (IEA-EBC) to make this possible. We appreciate the contributions of data and technical support documents from the PIs in 15 countries and 39 institutions. We also give thanks to Professor Gabe Fierro from the Department of Computer Science at Colorado School of mines, for his support on creating the Brick models.

### **BauSIM 2020 Roundtable Discussion**

BauSIM 2020 included a roundtable discussion with leading experts in the field of building performance simulation on the topic of "challenges and future endeavors". Participants for this discussion were Professor Joe Clarke (Professor Emeritus, University of Strathclyde, FIBPSA), Professor John Grunewald (Professor and Chair of Building Physics, TU Dresden), Dr Per Sahlin (CEO EQUA Simulation AB, FIBPSA), Dr Michael Wetter (Deputy Leader Simulation Research Group, Lawrence Berkeley National Laboratory (LBNL), FIBPSA), Andrew Corney (Product Manager at Trimble - SketchUp and Sefaira, UK; FIBPSA), and Professor Lori McElroy (University of Strathclyde). The discussion was chaired by Christina Hopfe.

This is the third and final extract from the discussion, which took place at the University of Technology (TU) Graz. The first and second extracts were published in the previous two newsletters, April and October 2021.

This part of the discussion started by considering a question submitted beforehand by Andrew Corney:

"Has simulation during COVID-19 really enabled practitioners to provide the guidance people need to safely return to buildings?"

Christina: Andrew, you have asked a very timely question. Should IBPSA really play a role in this?

Andrew Corney (Andrew): Well, I guess that's a really good question. In the UK, where I live, the government's had its foot on the accelerator and the brake about getting people to go back to work in an office. And although I haven't had time to comment on all of the documentation that CIBSE has written, I don't think our industry gave very clear guidance to people who own office buildings, or who rent office buildings, on how to determine whether or not that office building is really a good place to go back to. And there are many levels on which we don't provide that guidance particularly well. One might be in terms of helping people identify what characteristics a building actually has or what a tenancy actually has, which could potentially be solved by digital twins. But another level is how well are pollutants removed from the space, or how well is the space actually ventilated in real life and what would be the risks associated with certain

densities of people being inside that office space? And I don't think I've seen any really compelling things come out of our industry relating to this to help people answer or solve those questions. And I certainly don't think that we have software solutions or practitioners equipped to answer these questions at the scale that would be required for us to be able to be effective in society at answering these questions. It's not that we can't do it. It's not that we don't have software tools that can do that. But when you look at the capabilities of the practitioners and what we've trained them to do, which is essentially energy code modelling, and then you look at the time it takes to build simulation models that investigate dispersal of pollutants inside buildings, we are not equipping society to understand the risks of each and every office building as an office manager or as a tenant manager tries to work out whether or not that place is safe to go back to work - or how many people could be in that building, or how the building could be changed to make that place safer. And so I think that it's a real shame that we find ourselves in this situation where we have somehow let society down a little bit in the way we could have contributed to this problem and then how we have actually done that.

**Christina**: What do the others think about this? Should we actually be seeking to expand IBPSA's remit to the application of building simulation in buildings, or is that actually the role of other organizations?

**Per Sahlin (Per)**: Maybe I can respond to some extent to that. The name of the association is Building Performance Simulation Association and that should, in my opinion, include everything in the building that is modellable, so to speak, in a meaningful way. So, I wouldn't put any formal limits on ventilation efficiency. But I do see some very concrete problems with providing useful help to say something about the COVID-19 safeness



of a building. Because even if we did understand the mechanics of the infection – the way the infection spreads – just creating dynamical CFD models at the scale of whole buildings that would serve any useful purpose is absolutely not within the scope of what's possible today. In practice, you just don't do whole building CFD today, and if you do whole building CFD, you wouldn't do dynamical, whole building CFD and absolutely not over longer periods of time. So, this is just not possible, as I said, even if we wanted to.

**Andrew**: Yes. I think my point is that air quality has probably been something we've been a bit asleep at the wheel about as an industry because energy has been such a big deal. And I don't think we've found good ways to apply the capabilities that we have in simulation to answer some of those questions properly, even just with regard to things like minimum ventilation rates, or ventilation effectiveness within buildings; it's still a very, very slow hand cranked workflow. I'm not saying that I know what the answer is, but that as an industry we're finding ourselves in a situation right now where we could have been playing a much more valuable role in helping people. And we're not, and that's just unfortunate. That is all.

**Michael Wetter (Michael)**: I think IBPSA as a society should certainly be more proactive on how simulation can be applied to the different questions and then see what needs to be lined up so we can start addressing those questions. I feel quite disturbed that the evolution of simulation in the last few years has always been about code compliance - whether the building can pass ASHRAE 90.1 and all those things. It has really moved away from informing the design of buildings that was a much higher priority maybe 10 or 15 years ago. And now we see digitisation and semantic models and the need to provide more dynamic predictive control and integration with business models

I feel quite disturbed that the evolution of simulation in the last few years is has always been about code compliance - whether the building can pass ASHRAE 90.1 and all those things. It has really moved away from informing the design of buildings that was a much higher priority maybe 10 or 15 years ago. 77 (Michael Wetter) that, for example, start tracking your load, etc. There are a lot of new use cases. But there's not really enough of a concept to

figure out what we need to do to move our technology to a place where we can address some of those use cases and help there. We need to assess what can be done immediately and what kind of longer term research needs to be set up, or what standards need to be developed, so that we are not continuing in an ad hoc fashion to try to get it somehow to work, but really see what needs to be standardised so we can integrate it

in the digital workflow. What should use a standard application programming interface or data representation, etc. and what should not be standardised but be more open in terms of technology development, so we can have an innovative environment where we improve models or simulation technologies in a way that can then be integrated with other workflows through those standardised APIs. We need to see what needs to be embraced and further developed or adopted from other industries.

At this point John Grunewald rejoined the discussion, having dropped out earlier because his internet connection had dropped out, and was invited to comment on the questions that he had missed.

**John Grunewald (John)**: Yes, I just wanted to say we should not forget architects! I teach in the faculty of architects and I see how they work. It's normal that at the very beginning of a building design, almost all parameters are unknown, but they have questions about, say, an atrium. How does it work? You want to say "you should simulate it, then you will get an answer". And we would have to do this by hand. We can do these simulations. But of course, so many parameters are unsure or unknown. They haven't thought about this, that we have a real need to improve the situation so that we can provide well validated standard data for all these cases.







Michael, I completely agree with you: complicated or simple models are not the same as complicated or simplified user interfaces. We should differentiate user interfaces from the models behind them, and the user interface should be adapted to the user. And we need a very basic level, for instance, in the beginning when many things are unknown, and then you can step to the next level of complexity, for instance, and explore what lies behind. And sometimes architects may do this, but most of the time they don't want to do it. They just want a simple answer to a basic question: Can I build it in this way or that way? Or what is the advantage of this measure or this or that design? And I believe that building simulation needs to give an answer even at this very early stage of building design, otherwise we are only working in the range with much less freedom in making decisions. Most decisions are made in the very beginning and the highest degree of freedom is in the very beginning of the building design, so that's the point where I say the building simulation should come into play.

**Andrew**: Christina, can I make a quick observation? One of the things that I wanted to discuss, which we are doing now, and I think this has been a challenge for IBPSA, is the question of whether IBPSA is only representing the specialists and the academics in the industry? In some places we're very academic focused and we're not very well represented amongst practitioners. In the United States, I think to a degree IBPSA covers both practitioners and academics, but on the practitioner side, it's very narrowly focused and the loud voices are the specialists. One of the challenges, certainly as a software vendor or manufacturer/designer that is

addressing architects, is that there is a conflict of interest between what specialists want from the industry and what the industry should be making for generalist practitioners. The sort of software tools that could help an architect do a better design early on might be great for the industry, but they might take work away from specialists and be perceived as negative by certain people in the industry. I think this pressure has existed

IBPSA should also be thinking about how simulation should evolve to help people who are less technical, and helping to answer those questions from architects so that we can expand the reach of simulation using buildings rather than just focusing on it through a very narrow professional academic lens 77 (Andrew Corney)

for a long time and to some degree we're not doing the best that we could in balancing the interests of the specialists with the interests of all the practitioners who might use simulation. Specialists will always be needed and there will always be new developments, but IBPSA should also be thinking about how simulation should evolve to help people who are less technical, and helping to answer those questions from architects so that we can expand the reach of simulation using buildings rather than just focusing on it through a very narrow professional academic lens.

**Christina**: Andrew, your comment and John's comment were very much aligned in that direction. Now we have a question from Lori McElroy. Lori, can you hear us?

**Lori McElroy (Lori)**: Yes, I can hear you. I wasn't expecting to be brought into the conversation. All I really wanted to say was that I agree very much with the fact that if we want to engage with the professions, then we really have to address the application side of things. We have talked about this a lot. IBPSA is very good at criticising itself for being overly academic, but we are not very good at giving a platform to the application of simulation, which is equally of value. I think quite often when we have papers about applications, they're subordinated or they appear to be subordinated to a lesser platform, whether that's a poster or a kind of niche type of presentation. So, I really think that we need to look at this because we've tried for years to embed simulation in practice and we've had varying degrees of success. But I think that time pressures make it difficult for practitioners to adopt full blown simulation. So I'm very interested in what Joe had to say about protecting practitioners from the complexities and difficulties of using full blown simulation programs, but still giving them access. I think that the other thing is that, picking up on what Andrew just said, there's this thing about us

pushing technologies on practitioners which really don't answer their questions. So, we really need to be looking to get more of a pull from the practitioner's side of things, to see what it is that they actually want. And the only other thing that I'd started to type, but it disappeared when you made me a panellist, was that I think in a post-COVID world, there will be huge opportunities for things that have been seen (I said this yesterday) as niche applications of simulation, like clean rooms, flows of people in spaces, evacuation; those sorts of things will all be catapulted up the agenda in this new world, and simulation of external air pollution, which I know Bert Blocken is working on. And I'm hoping to see something in the next IBPSA newsletter.

**Christina**: Indeed. Thanks for the advertisement! (*ibpsa*NEWS vol 30 no 1 includes an interview with Bert Blocken on Modelling droplet dispersion in the context of COVID-19).

Lori: I got a full statement in there!

**Christina**: What you say is interesting, Lori, because we had the idea of a second IBPSA journal which was dedicated to case studies, practitioners, and it, kind of, zoned out because we felt there wasn't enough interest. Is that something, in line with what you and Joe have been saying, that you think we should bring back to the table? To have a publication just dedicated to applications?

**Lori**: I think that maybe the thing about it is that at the moment this is very much internally IBPSA driven. And maybe we should be going out to the industry to find out what the industry wants support with. I know that the professions like ASHRAE and CIBSE have groups dedicated to simulation but maybe we want to tighten up that tie between the two, without us being overtaken by these large industry bodies or professional bodies. Because I think that we have an important role to play.

**Joe Clarke (Joe)**: I think the construction industry is very taken by, very influenced by, case studies; where the architects can look at how another building was designed and what its principles are. I think if you could plan for another practitioner/ case study based journal, that is a phenomenally good idea - a publication where you can see how a simulation was applied in prestigious and ordinary buildings. Wow, that's amazing. Go for it.

Christina: Well, John, final comment, because we have to come to an end.

**John**: We aren't the first ones who applied these tools, and this makes sense. And everything is application driven. Therefore, for now, it's good to have something in place, like a journal, that shows off the range of applications, the potential of all these tools. But just by more applications, we will not overcome the problem of fragmentation of the whole field. So, we will still have different tools with different technologies and backgrounds and we will never have the only tool that can do everything. I think that for me, the most challenging topic is the interfacing, the interoperability of these tools, though. And then maybe if we get better or work together in this field, which should be driven by politics. This should be driven by the vision of politics - if they have a vision. Then we could make it. That's my opinion.

**Christina**: I think that is a good place to bring this discussion to an end, John, because your point links back to my first question at the beginning, when I asked Joe whether it was possible to imagine a future where we would have that.

Thank you all very much for your inputs. It has been a very valuable discussion.





# **Forthcoming events**

Date(s)	Event	Further information
2022		
21-24 June 2022	<b>eSim</b> Ottawa, Ontario, Canada	https://www.carleton.ca/esim22
25-29 June 2022	ASHRAE Annual Conference Toronto, Ontario, Canada	www.ashrae.org/conferences/ashrae- conferences
29 June - 1 July 2022	Building Simulation Applications (BSA) Bolzano, Italy	https://bsa.events.unibz.it
20-21 July 2022	IBPSA-Australasia Conference Brisbane, Australia & online	https://www.airah.org. au/BuildingSimulation/Home/ BuildingSimulation/Home. aspx?hkey=eaadbcc7-3708-4966-85aa- 2f4f0cb6ff31
03-05 August 2022	International Radiance Workshop Toronto, Ontario, Canada	https://www.rw2022.com
20-23 August 2022	BuildSim Nordic online	http://ibpsa-nordic.org
12-13 September 2022	Building simulation and optimization online	https://www.bath.ac.uk/events/building- simulation-and-optimisation-in-the-global- south
14-16 September 2022	SimBuild 2022 Chicago, Illinois, USA	https://www.ibpsa.us/2022-ashrae-and- ibpsa-usa-building-performance-analysis- conference-and-simbuild
20-22 September 2022	BauSIM Weimar, Germany	www.bausim2022.de
20-23 September 2022	International HVAC+R Technologies Symposium (IBPSA Turkey) online	https://ttmd.org.tr/en/activities/xv-ttmd- international-hvac-r-technologies- symposium
25 November 2022	uSim 2022 Glasgow, Scotland, UK & online	http://usim2022.org/webpages/about_ uSIM22.html
2023		
04-08 February 2023	ASHRAE Winter Conference Atlanta, Georgia, USA	https://www.ashrae.org/conferences/ ashrae-conferences
20-23 May 2023	IAQVEC Tokyo, Japan	https://iaqvec2023.org
04-06 September 2023	BS 2023 Shanghai, China	https://bs2023.org

Note that the dates in this calendar may, but do not necessarily, include pre and/or post-conference workshop days



21-24 June 2022 Carleton University, Ottawa, Ontario, Canada www.carleton.ca/esim22

### eSim 2022



IBPSA-Canada is pleased to invite the world to the 12th biennial eSim Building Simulation Conference on 22-23 June 2022, and workshops on 21 and 24 June, with the theme "Simulating Buildings for the New Normal". These dates were selected to precede the ASHRAE Conference in Toronto (25-29 June 2022). The conference consists of two days with typically over 75 peer-reviewed paper presentations, as well as two days of theory and software workshops, a technical tour, and a banquet. The eSim conference is well-established and continues to grow, this year expecting to have over 200 delegates. Visit us at www.carleton.ca/esim22 for updates.

- Abstract Registration: 30 October 2021
- Paper Submission: 15 February 2022
- Paper Notification: 01 April 2022
- Camera Ready Submission: 15 May 2022

Carleton University is in the Nation's capital city, Ottawa, and is scenically surrounded by the Rideau River and the Rideau Canal, a UNESCO World Heritage Site. The Rideau Canal is also the largest skating rink in the world. However, typical June weather sees highs of 25°C, so hikes along the Canal and in the nearby parks systems would be more seasonal! Ottawa is a city of 1.2 million diverse residents, world-class museums, and has direct flights to most Canadian cities and



European and American hubs. It is also a short train ride away from Montreal, Toronto, and Quebec City.

Please direct questions to eSim 2022 Chair, Burak Gunay, burak.gunay@carleton.ca

20-21 July 2022 Brisbane, Australia www.ibpsaaustralasia.org



### **IBPSA-Australasia regional conference**

IBPSA-Australasia will be hosting a regional conference in July 2022 in sunny Brisbane, Australia. The conference themes will centre on real world outcomes from simulation applications.

We are looking for papers and presentations focused on delivery and results, as well as how industry can learn and evolve to improve climate responsive design outcomes. This will be a hybrid conference with some content and participation available online. We invite submissions from around the region as well as internationally. Please check our website www.ibpsa-australasia.org or follow us on LinkedIn to be notified about the call for papers.





#### CALL FOR ABSTRACTS Deadline 1<sup>st</sup> of October 2021

BuildSim Nordic 2022 conference is to be held on the 22-23th August 2022 hosted by Technical University of Denmark, Department of Civil Engineering, Denmark, organized in cooperation between the Danish chapter of IBPSA. The conference programme includes a technical tour and a dinner at a secret place. The purpose of the event is to create a platform for exchanging ideas, issues and research findings, in the field of building performance simulation. It facilitates national & international collaboration, and the meeting of minds between practitioners, researchers and students.

#### Participants

The event is open for members and non-members of IBPSA-Nordic. Any research related to building simulation, including system design, HVAC, energy production/use, indoor climate and environmental issues, is eligible to be presented at the event.

#### Topics

- Building acoustics
- Building Information Modelling (BIM)
- Building physics
- CFD and air flow
- Commissioning and control
- Daylighting and lighting
- Fenestration systems
- Developments in simulation
- Education in building performance simulation
- Energy storage
- Heating, Ventilation and Air Conditioning (HVAC)
- Human behavior in simulation
- Indoor Environmental Quality (IEQ)
- New software developments
- Optimization
- Simulation at urban scale
- Simulation vs reality
- Solar energy systems
- Validation, calibration and uncertainty
- Weather data & Climate adaptation
- Zero Energy Buildings (ZEB)
- Emissions and Life Cycle Analysis

### BuildSim Nordic 2022 22-23<sup>th</sup> August Copenhagen, Denmark



### International Building Performance Simulation Association

#### Abstracts

The abstracts should be

- Written in English;
- No more than one A4 page in size;
- A template will be made available;

#### Language

The event will be held in English.

#### Submission process

All authors whose abstract is accepted will be invited to submit a full paper. All accepted papers will be invited to give an oral or poster presentation at the event.

The papers accepted for oral presentation will be published in the conference proceedings published by:

SINTEF Akademisk forlaget: https://www.sintef.no/byggforsk/sintef-akademisk-forlag2/ SINTEF Proceedings is an Open Access publication accepted as Level 1 publication in Norway, Denmark and Finland.

#### Key dates

1st October 2021Abstract submission1st December 2021Acceptance of abstracts1st February 2022Submission of full paper15th April 2022Acceptance of full paper1st June 2022Submission of final paper

### Additional information at:

http://ibpsa-nordic.org/ Contact info.: masak@byg.dtu.dk jerik@byg.dtu.dk

Background Image: Cockle Bay Park, Sydney Australia © Henning Larsen 25 November 2022 online http://usim2022. org/webpages/about\_ uSIM22.html



### uSIM 2022: 3rd IBPSA-Scotland Conference

### Urban Energy in a Net Zero World

The 3rd IBPSA-Scotland Conference will be hosted by the University of Strathclyde, Glasgow, Scotland on 25 November 2022. Given the ongoing COVID situation and to minimize our carbon footprint, uSIM2022 will be wholly on-line this year, at https://usim2022.org.

### **Call for Abstracts**

The focus of **Urban Energy in a Net-Zero World** is on the built environment and how its energy needs can be transitioned to net zero.

The core topics for uSIM2022 are:

- Modelling and simulation of urban areas and communities
- The new electrical demand the electrification of heat and transport
- Modelling and simulation of urban energy networks
- Hydrogen in buildings and communities
- Smart energy orchestration of demand, supply and storage
- Zero carbon technologies for urban areas and communities
- Cooperative approaches to net zero positive and negative energy districts
- Data analysis, visualisation and performance metrics
- Domestic and non-domestic stock modelling
- Calibration, verification and validation beyond the building scale
- Case studies in urban and community energy systems modelling

Papers in areas related to, or spanning, these themes are also welcome.

Abstracts can now be submitted via the conference website at https://usim2022.org. All abstracts and papers for uSIM2022 will be peer-reviewed by members of the Scientific Committee. The deadline for abstract submissions is 30 April 2022.

We aim to make uSIM an affordable conference and encourage paper submissions from underrepresented groups in the building simulation community.

We look forward to your contributions, The uSIM Team



4-6 September 2023 Shanghai, China https://bs2023.org info@bs2023.org

### BS 2023: 18th IBPSA International Conference & Exhibition

Following the successful BS 2021 in Bruges, Shanghai will take the relay in hosting our next world building simulation conference! BS 2023 is scheduled for 4-6 September 2023, so mark your calendar and prepare the travel budget!

Shanghai, which literally means "City on the Sea", lies on the Yangzi River delta at the point where China's main waterway completes its journey to the Pacific. In the past 200 years, Shanghai has experienced a booming development from a fishing village to the financial center of China. The colonial history left the city with copious architectural styles from art deco to neoclassicism, together with the oriental Buddhist temples, home-grown Lòngtáng and Shíkùmén housing, making it a diverse architectural heritage. Symbolic of concession-era Shanghai, the Bund hosts a great view contrasting the bones of the past with the



futuristic geometry of Pudong's skyline, the Oriental Pearl Tower and the Shanghai Tower. Below, lies our main venue, the International Convention Center.



The organization committee is a dynamic team with people from two acknowledged universities (Tongji and Tsinghua) and sponsors, chaired by Professor Yiqun Pan and Professor Da Yan. As a returning event since BS 2007 Beijing, the regional affiliate IBPSA-China is honored to invite all

researchers, developers, practitioners, and policymakers to this warm reunion. The theme relates with all spheres of building simulation towards a low carbon design, operation, and city development. Shanghai, the metropolis with its enormous energy consumed and data produced, serves as a great context of topics from cutting-edge technologies to the renaissance of cultural heritage.

Since the pandemic in 2020, Shanghai has demonstrated its strength in ensuring public health and openness at the same time. With safety assured, we will present various social events to our community, including a cultural cruise along the Huangpu River. If time is available, you may explore all mainland attractions apart from the famous water towns skirting around Shanghai. It only takes a few hours by the high-speed rail network in China.

Few cities in the world evoke so much history, glamour, mystique and exotic promise in name alone. A warm welcome in Shanghai!

### Software news



### CityFFD – Urban environment and energy simulations on GPUs

Understanding the multi-physics and multi-scale interactions for urban environment and energy performances is becoming essential, driven by broad concerns over climate change and interests in smart city designs and operations. Such an analysis is often associated with computational fluid dynamics simulations of urban aerodynamics and thermal conditions at a building level, whereas existing models have been limited by computing costs, data availability, and large-scale validations and accuracies. Dr. Leon Wang's team at Concordia University developed CityFFD – City Fast Fluid Dynamics, with its supporting web portal of digital cities. Speed and accuracy are maintained through novel numerical algorithms with large eddy simulation implemented on graphics processing units (GPU) and validated through a wide range of benchmark cases. We demonstrated a new approach to modeling urban microclimate by CFD on GPUs widely available on modern PCs.

Learn More at https://users.encs.concordia.ca/~leonwang/moodle/ and https://doi.org/10.1016/j.uclim.2021.101063.

### cove.tool update their HVAC design software, loadmodeling.tool

In 2021, cove.tool launched loadmodeling.tool (https://www.cove.tools/ loadmodelingtool-hvac-design), a robust HVAC design and load modeling program designed to empower mechanical engineers, energy modelers, and HVAC contractors to design, optimize, and collaborate within the cove.tool platform. The automated tool can help establish peak cooling and heating loads to design and right-size mechanical systems. The software's interoperability and ease of use has revolutionized the way engineers design and optimize their models.



### How does it work?

loadmodeling.tool uses the EnergyPlus engine for detailed, room-by-room load calculations and HVAC system sizing. Models are created via a web interface that provides full customization of geometry, templates, schedules, systems, and more. The defined model is then processed with the help of the OpenStudio SDK, and a simulation is run, all on the cloud. Models and results are accessed via a web-interface for quick performance and ease of sharing results with large teams. The entire model is always exportable to OpenStudio and EnergyPlus native files for use or record keeping offline.

### When is loadmodeling.tool used?

Engineers and contractors use loadmodeling.tool from early schematic design phases until the end of construction. At the schematic and design development stage, it helps right size equipment for selections and automates the evaluation of energy-saving concepts, such as the effects of daylighting, HVAC optimization strategies, and highperformance glazing. At the construction drawing phase, the model can be updated further to produce final zone, system, and mechanical plan sizing reports.

The software is continually being updated to provide more powerful features and functionality.

### **Key Features**

- **Room Templates** handles creation, customization, assignment and saving back to the library templates for rooms. This is where internal gains, set points and outside air flow rates are assigned.
- Schedules handles creation and customization of all detailed schedules, which are assigned throughout loadmodeling.tool. Here specific schedules for equipment, lighting, occupancy, etc. are created for use or saved back to the library.
- Project Data Editor allows for in depth view into the project details. In version 2 zones can be created and assigned here, along with zone assignment to air systems.
- Air System Inputs handles the creation from template and customization of Air Systems. Air Systems include all central and local equipment that provide the heating, cooling and ventilation to zones. Air Systems can be sized with the platform.
- Results provides reporting of cooling and heating loads for each Zone and each Air System in a model. A detailed breakdown of the load is provided in an easy to understand graphic. Full results can be downloaded from this page to a spreadsheet or pdf.
- General Settings includes the high-level settings of the model, such as heating and cooling sizing factors. The run simulation button, along with weather and design day controls. The building analysis model can also be downloaded here as a .osm, .idf, .gbxml.

### Latest updates

loadmodeling.tool Version 2.5 offers several new air system components, including:

- Active Chilled Beams
- Parallel Fan-Powered Boxes
- Series Fan-Powered Boxes
- Induction Units
- Local Fan Coil Units
- Packaged Terminal Air Conditioners (PTAC)
- Water to Air Heat Pumps (WAHP)
- Energy Recovery Ventilators (ERV)
- Packaged Terminal Heat Pumps (PTHP)
- Unit Heaters
- Radiant Cooling Panels (RCP)
- Baseboard Heaters

and a Project Input Report which summarises the key project inputs.

### **Upcoming Features**

- Mechanical Plant Modeling and Sizing
- Room in Zone results
- Ventilation Calculation Tool
- Improved BIM imports
- Additional automation and templates

More information about loadmodeling.tool is available from on our website at https://www.cove.tools/loadmodelingtool-hvac-design.

### LUMO: a learning tool for sunscreen & daylighting design

Aloísio Leoni Schmid, Professor, Graduate School of Civil Engineering, Federal University of Paraná, Curitiba, Brazil, iso@ufpr.br

LUMO was conceived to support the learning of solar geometry concepts in an innovative way. It uses an interactive graphic interface that resembles a spaceship cockpit, with a kind of tracking ball that governs the time macro-scale, and a power grip that controls the time micro-scale with the movement of a photon from the sun to the building on Earth. In doing so, it reveals the Astronomic origin of well-known rules of thumb used in the design principles of sunscreens.

Once the day of the year and the time of the day are set, Earth is approached up to the point the photon sees an outdoor isometric perspective of the building with the window. Solar incidence and daylighting parameters can be simulated at this stage. Next, a sunscreen is input as composed of prismatic elements (in the shape of brisessoleil, marquise, venetian blind or other devices). Finally, daylighting parameters with the sunscreen are calculated, providing comparison criteria. Different resources like the solar chart, isolux lines and Spatial Daylight Autonomy (SDA) and Annual Solar Exposure (ASE) plots are available. Figures 1 and 2 illustrate a typical run of LUMO.



A sun ray targeting Curitiba, Brazil (lat. -25°, long. -49°). Date is June 21, Winter solstice in the Southern hemisphere, at 4 P.M. Above, left: overcast sky model. Right: Earth orbit scheme



View from a photon approaching View from photon closer to building Earth and turning 180° around its showing north-facing window own axis

Fast daylight render and isolux plot under overcast sky

Written during the first pandemic year of 2020 in Java, LUMO implements the modeling of solids as diverse in scale as the sun, the Earth, and a room of rectangular plan to be lit by a single window which may be on a vertical, sloped or horizontal façade plane (last case is that of a skylight). It may also comprise an upper pane of a different glazing type (e.g. translucent). LUMO also models something as thin as a single venetian blind. The Earth with the building on it and its sunscreen undergoes a translation around the sun and a rotation around its own axis that is inclined at 23°45′ to the ecliptic plane. That allows the precise modeling of shadows in the room scale.

The atmosphere is modeled according to the various CIE sky models, providing a distribution of diffuse light, comprising both sky and albedo. That allows the numeric simulation of daylight in the room. Several, well-known Computer Graphics techniques are used to produce images, which are different kinds of perspectives. Rendering itself is supported by the use of numeric methods of raytracing and radiosity.

Figure 1

#### Figure 2



Solar protecting device entered by coordinates on the panel right side. It consists of three prismatic solids: a marguise and two vertical, trapezoidal fins



Isolux plot with sunscreen

Solar stain plot (clear sky)

Architect Rafael Santos Fischer, an experienced user of building simulation software and developer, wrote that LUMO is a rather useful tool to help architects design, assess, and evaluate sunscreens in building design. It saves designers modeling time by providing a default building template. All-in-all, the software has a great potential to be a helpful tool during the design processes, producing data that can drive a more scientific building design process. In a semester beginning in February, 2021, the author's own, 4th semester architectural students at UFPR were (individually) assigned a task of designing an effective sunscreen for an existing window in their own residence. The majority of a group of 50 students preferred LUMO to usual plugins of building modeling tools and declared themselves satisfied with its usability.

For free download, installation and operation, see Lumo's handbook at https://www.researchgate.net/publication/344159353\_LUMO\_20\_FOR\_SUNSCREEN\_STUDY\_AND\_DESIGN\_SOFTWARE\_HANDBOOK



### *Oops ...* New Global Simulation Climate Data Set from Climate. OneBuilding.Org

Oops... in last fall's IBPSAnews, we said that an updated TMYx climate data set with data through 2020 was available. For multiple reasons (data synchronization of multiple data sources, etc.), we were not able to complete that update. But now, we have updated the TMYx climate data set with data through 2021.

In early 2022, Climate.OneBuilding.org updated their worldwide TMYx data set with weather station meteorology data through 2021 and corresponding solar radiation from the ERA5 reanalysis data set (https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5). The ERA5 data, courtesy of Oikolab (https://oikolab.com), provides a comprehensive, worldwide gridded solar radiation data set based on satellite data. The new data set adds more than 1000 new locations (>10% increase), bringing the total to more than 14,500 locations. These (and all other weather files on the site) also include the latest ASHRAE 2021 design conditions.

The TMYx are derived from hourly weather station meteorology data through 2021 in the ISD (US NOAA's Integrated Surface Database) and gridded solar radiation data from ERA5 reanalysis using the TMY2/ISO 15927-4:2005 methodologies. Often, there are two TMYx for a location, e.g., for Washington Dulles Intl AP: USA\_VA\_Dulles-Washington.Dulles.Intl.AP.724030\_TMYx and USA\_VA\_Dulles-Washington.Dulles. Intl.AP.724030\_TMYx.2007-2021. In these cases, there's a TMY for the entire period of record and a second TMY for the most recent 15 years (2007-2021). Not all locations have recent data.

With this update, Climate.OneBuilding.org now provides TMYx climate data at no cost for more than 14,500 locations worldwide and another 3,200 from other data sources. All data have been through extensive quality checking to identify and correct data errors and out of normal range values where appropriate.

Each climate location .zip contains: EPW (EnergyPlus weather format), CLM (ESP-r weather format), WEA (Daysim weather format), and PVSyst (PV solar design weather format NEW!) along with DDY (ASHRAE design conditions in EnergyPlus format), RAIN (hourly precipitation in mm, where available), and STAT (expanded EnergyPlus weather statistics).

For more information or to download any of the weather data (no cost), go to http://Climate.OneBuilding.org



### **EWE: Exemplary Weather and Energy index**

Exemplary Energy publishes, as a free monthly benchmarking service to industry, the Exemplary Weather and Energy (EWE) Index. At present the EWE Index is available for Brisbane, Canberra, Perth and Sydney, and the authors aim to expand the service to all eight capital cities in Australia in the coming weeks.

The weather part of the EWE analysis is focused on comparing the mean dry-bulb temperature, relative humidity, wind direction and wind speed of the current month to the long-term average, based on Real Time Year (RTY) datasets that are produced continuously as compared to the Reference Meteorological Year (RMY) for each location. The figure below shows the monthly infographic summarising the weather analysis for February 2022.



### Weather index for February 2022 - monthly means

EWE index infographic - February 2022

The energy part of the EWE analysis is based on energy models of three archetypical buildings – a 10-storey office, a 3-storey office and a single level supermarket – and an optimum-tilt residential solar PV system. We apply the RTYs to the models, presenting the results in the form of deviations of the monthly means of minimum, average and maximum recorded data, as well as a comparison of the energy performance of the buildings and the PV system.

The EWE index ultimately aims to support PV owners and Green Star, SmartScore, NatHERS and NABERS-rated building owners and facility managers. Users employ the tools to determine the likelihood that lower performance is being driven by weather anomalies, and to trigger investigations into underperforming buildings and promptly evaluate potential corrective actions as appropriate.

More information can be found at https://exemplaryenergy.wordpress.com



### DesignBuilder releases new free short tutorials, case studies, and webinars

### **New tutorials**

DesignBuilder have released a new series of free short tutorials that provide concise guidance to help you get started using the software. They also enable existing users to refresh their knowledge with the latest tools, techniques, and tips to help improve their modelling efficiency.

A few highlights in this latest series of tutorials include:

- Using geometry convention templates to ensure correct volumes and surface areas.
- Using the same model to comply with codes having different geometric conventions (gross/net areas/volumes) without rebuilding your model.
- Specifying the performance of opaque building fabric and glazing.
- Quickly and easily applying opening and shading data to selected facades.
- Modelling the time-varying heat gains in a building from occupancy, equipment, lighting etc., and the time-varying operation of HVAC systems.

The tutorials are freely accessible at https://designbuilder.co.uk/training/tutorials and cover several essential areas of DesignBuilder modelling. If you have never received DesignBuilder training or were trained using earlier versions of the software, we would strongly recommend that you view these short high-impact tutorials.

### **New case studies**

### Fabric and service design for a college teaching building in South India

PSI Energy (https://psienergy.in) used DesignBuilder's tools to optimise the fabric and service design for a college campus teaching building in South India, aiming to discover the architectural and system design solutions offering the best energy performance at the lowest cost. The detailed analysis enabled the team to identify a set of optimum solutions and to provide suitable recommendations in timescales that would not be possible using traditional iterative simulation methods. You can read more about the project in https://designbuilder.co.uk/casestudies/ PSICaseStudyCampusOptimisation.pdf

### Sensitivity analysis to simplify and speed up optimisation

In this case study, written by Chad Isnor, a Sensitivity Analysis is carried out as a precursor step to improve the clarity and accuracy of the design optimisation outputs. If you've ever wondered how to go about systematically quantifying and ranking the impact of the various design decisions in your simulation projects, then this case study is well worth a look. You can read more about the project in https://designbuilder.co.uk/casestudies/PSICaseStudyCampusSAImprovesOptimisation.pdf

There are more case studies at https://designbuilder.co.uk/about-us/case-studies.

### **New Webinar**

A new webinar *Modelling HVAC Systems: From Concept Through Detailed Design* has been added to our website at https://designbuilder.co.uk/training/webinars. This webinar explains the HVAC modelling capabilities in DesignBuilder, illustrating which is best for early and detailed design and so on.

For up-to-date information on new webinars, case studies and software releases, you can subscribe to our free monthly newsletter at https://designbuilder.co.uk/about-us/newsletter.

### **Building Simulation 2025** Call for Proposals

The board of IBPSA is pleased to issue the following call for proposals from parties interested in hosting the international conference Building Simulation 2025. A complete proposal should be sent to the Conference Committee chair, Paul Strachan (p.a.strachan@strath.ac.uk), no later than 30th April 2022. Discussions with the Conference Committee chair of potential proposals prior to the due date are encouraged. The proposal should address the following items:

- proposed venue
- dates
- details of conference secretariat
- organisation time line
- format of conference (see below)
- details of rooms for plenary sessions, parallel sessions and posters
- availability of free Wi-Fi connections for participants
- detailed budget in local currency and in US dollars, including estimates of registration fees for both onsite and on-line participants, as appropriate
- discussion of possibilities for sponsorship
- details of the conference presentation schedule (e.g. number of parallel and plenary sessions), including innovative ideas for conference delivery methods and audience interaction
- publication of proceedings
- details of accommodation, including costs, for delegates and students
- social events
- options for pre and post conference tours, software demos and courses
- options for programme for accompanying persons
- involvement of existing or planned IBPSA Regional Affiliate(s)
- experience of the organising committee with IBPSA and with organisation of similar conferences. Note that the BS'19 conference had around 1000 participants.
- conference software for scientific review and registration: Conftool (https://www.conftool.net) is the preferred option as it has been widely used in previous conferences and there is support for its use by IBPSA.

### Format of conference

IBPSA is aware of the need to reduce environmental impact of long-distance flying, but also recognises the benefits of face-to-face exchange of ideas and networking opportunities, and the timing difficulties with interactive on-line sessions for a global audience. IBPSA's preference is for a hybrid conference with a high quality on-site conference, whilst also allowing on-line participation from all time zones. Proposers should give a clear and costed description of their proposed conference format. Proposers should address how they will accommodate on-line attendance for all time zones, and whether they will allow on-line presentations.

Proposers should also describe how they would approach conference delivery if travel is severely restricted. This might include issues such as moving fully online and the cost implications of cancelling venues and other activities.

To assist your decision there are several documents available (please email the Conference Chair for information):

- The IBPSA Regionalization Guide (available at www.ibpsa.org/downloads/IBPSA-Regionalization-Guide.pdf) describes IBPSA's regionalization plans: we schedule all of the Building Simulation conferences in regions with existing affiliates or regions that are starting a new affiliate organization. In a region currently without an affiliate, we will only consider holding the conference there if a regional affiliate organization will be in place by the time of the conference.
- Final reports for previous Building Simulation conferences, which include details of organization, finances (e.g. planned budget and actual expenses), post-conference surveys and other information useful to organizers of future Building Simulation conferences.
- A document on sponsorship contains suggestions regarding the exposure and benefits of Building Simulation sponsors.
- A recent Memorandum of Understanding serves as an example for the contract which will be agreed between IBPSA and the organizers of Building Simulation 2025.
- A budget template.

### **Evaluation criteria**

Proposals will be evaluated using the following criteria:

- Attractiveness and accessibility of location is this location likely to attract delegates from around the world? (10%)
- Affordability of venue is the combination of registration fee and accommodation costs likely to be acceptable to potential delegates? (In this respect, a range of accommodation types including student hostels is a benefit.) (10%)
- Quality of conference plan and facilities are the facilities and conference plan conducive to a well-run environmentally sustainable conference? (10%)
- Format of the conference does the format appear attractive for both on-site and on-line participants (10%)
- Likelihood of financial success will the conference financial plan likely lead to breaking even (at least)? Is the conference likely to be affordable for a range of participant types? A financial plan that does not rely on unconfirmed sponsorships to break even is strongly preferred. (20%)
- Approach to conference delivery in the event of severe travel disruption. (5%).
- Support of IBPSA goals will choosing this proposal help draw new members into IBPSA (in new regions) or support membership in existing regions? (5%)
- Diversity of location is this location sufficiently distant from recent conferences? (10%)
- Regional participation is the proposal well-supported by volunteer effort from the regional affiliate and/or nearby regional affiliates? (10%)
- Experience of members of the organizing committee with IBPSA, and with organizing IBPSA affiliate conferences or conferences similar to Building Simulation. (5%)
- Industry input are there good prospects for participation by practitioners alongside researchers? (5%)

The final decision regarding the location of Building Simulation 2025 resides with the IBPSA Board of Directors and will be made following a thorough evaluation of all submitted proposals.

A decision regarding proposals can be expected by the end of June 2022.

# **Godfried Augenbroe Memorial Prize**

As many of us are acutely aware, last year our friend and mentor Fried Augenbroe passed away. Since then efforts have been underway to set up a memorial prize or fund. From a survey in 2021 we collected ideas and suggestions, and concluded that the most appropriate option would be to establish a prize that supports young PhD students, as that is where Fried's heart truly was, and this would best operate through IBPSA. We have discussed this idea with the IBPSA Awards and Fellows Committee, who fully support this initiative. The new prize will target PhD students who are still working on their thesis and who participate in the IBPSA Building Simulation Conference. We will formally establish the prize once we know how much money is available, through the Committee.

We are have now started fundraising for the Godfried Augenbroe Memorial Prize. A first £10k has already been donated, and transferred to the IBPSA Bank Account. However further donations are welcome. To contribute, the easiest option is to use the GoFundMe campaign that we have set. Alternatively you may contact one of us to discuss other arrangements:

- USA:
  - Ji-Hyun (Jeannie) Kim at Argonne National Laboratory if you consider yourself primarily as an IBPSA-USA member;
  - Yuna Zhang at Baumann Consulting if you are a GeorgiaTech alumnus;
  - Zhaoyun Zeng at Lawrence Berkeley National Laboratory if you have another background.
- China: Zhengwei Li at Tongji University.
- **South-Korea**: Cheol-Soo Park at Seoul National University.
- **European Union, UK or elsewhere**: Pieter de Wilde at the University of Strathclyde.

If you have any questions about these arrangements, then please feel free to contact Pieter de Wilde. You may also contact Wangda Zuo (Treasurer of IBPSA) or Liam O'Brien (Chair of the Awards and IBPSA Fellows Committee) for independent third-party confirmation that this a bona-fide fundraising effort.

We look forward to your help to keep the memory of Fried alive.

Best regards,

Pieter de Wilde Cheol-Soo Park Ruchi Choudhary Jeannie Kim Yuna Zhang Zhaoyun Zeng Zhengwei Li



# New affiliate: IBPSA-Iran

### Zahra S. Zomorodian, IBPSA-Iran President

IBPSA-Iran was formed in January 2022 as IBPSA's thirty-second regional affiliate.

Iran holds some of the world's largest deposits of oil and natural gas, making it the largest energy consumer in the Middle East (2019) and amongst the top 10 countries contributing to carbon emissions worldwide. Despite the high energy consumption in the building sector (2.5 to 4 times higher than global mean), discomfort conditions are reported, and buildings' performance is rarely evaluated in the design stage. However, in recent years, mandatory regulations, governmental economic incentives, and green building rating schemes, codes, and standards have been implemented to promote energy efficiency in the building sector.

There is a high level of building performance knowledge in Iranian universities and related research institutes, but outcomes are not yet applied in real-world practice. Therefore, a group of notable scholars and professionals in the field of building science formed IBPSA-Iran in 2021 (approved January 2022) with the aims of being a powerful channel for education and research, disseminating the principles of sustainability in the building industry through building performance analysis, and filling the gap across academia and industry.

IBPSA-Iran will strive to achieve these objectives through regular meetings, webinars and conferences at the national and regional levels and will seek to increase interaction amongst members through social media and its website, especially between universities and industry partners. IBPSA-Iran will create opportunities for members and will provide a virtual platform for the effective marketing and launching of new simulation software through exhibitions, presentations, and advertisements.

IBPSA-Iran's activities will be organised through five main committees (Research, Education, Data Exchange, Communication and Software Development) where members will have the opportunity to participate in meetings and exchange information.

Simulation activities (such as education, research, and discussion groups) will be categorized into six sections including Energy Modeling, Lighting Modeling, Acoustic Modelling, Ventilation Modeling, Fire Modeling and Hydrothermal Modeling. Further information is provided on our website, http://ibpsa.sbu.ac.ir.



On behalf of the IBPSA-Iran board, I would like to thank the IBPSA World committee for their trust and support. We look forward to collaborating with other affiliates using their experiences to expand our activities and holding regional and international IBPSA conferences in the future. In addition, I am pleased to invite all Iranian building performance scholars and professionals living in Iran or abroad to join. Our members' extended knowledge, expertise, and experiences in the area will bring great value to IBPSA-Iran.

### **IBPSA** to establish two new committees:

### Standards and Equality, Diversity & Inclusion

### **Standards Committee**

At their recent meeting, the IBPSA board approved the formation of an IBPSA Standards Committee. This follows the approval of IBPSA as a co-sponsor of ASHRAE Standard 209, Energy Simulation Aided Design for Buildings except Low Rise Residential Buildings. ASHRAE has formed a Standards Project Committee to update the 2018 version and IBPSA members will be involved.

The IBPSA Standards Committee will provide a venue to provide input to this, EU, ISO, and other standards activities throughout the world. If you are interested in participating on the IBPSA Standards Committee, please contact Dru Crawley (dbcrawley@gmail.com).

### Equality, Diversity and Inclusion (ED&I) Committee

### Rob McLeod

There is a general presumption that IBPSA is a non-denominational scientific organisation that actively encourages membership and participation from all walks of life. As evidence of this you might point to the fact that the current IBPSA-board of directors has an equal number of members that identify as male and female. But whilst these principles, grounded in the concept of 'fairness', may be etched into some of our hearts and minds - they are nowhere written down. If IBPSA wishes to make its position clear and contribute to societal advancement with respect to Equality, Diversity and Inclusion (ED&I) on a global stage, then some degree of formalisation is needed. It is this realisation which has prompted the formation of the new ED&I committee.

In the wider community there is a growing awareness that non-profit organisations can play an important role in advancing the cause of ED&I through every aspect of their governance and operations. The next, more difficult, step forward is to turn these aspirations into action. How do we, as part of the non-profit community dedicated to the benefit of the wider public, effectuate our commitment to ED&I? In other words what steps can we take to make our organisation and its activities more diverse, equitable, and inclusive?

Organisational commitment to ED&I may be demonstrated in many ways, including through governance policies, recruitment, training, power-sharing, leadership, awards and perhaps most importantly, through accountability. Accountability implies adherence to agreed codes of conduct, policies, and bylaws as well as transparency in how such policies are implemented. Bylaws that include an ED&I purpose statement and provisions function as a sign that the organisation will devote meaningful resources to enacting those values. Drafting an ED&I purpose statement will therefore be one of the first tasks of the ED&I committee. The Bylaws may also require that an annual ED&I audit report is provided to the Board, in order to hold itself accountable to its values and to benchmark progress.

Being at the forefront of encompassing ED&I will not happen overnight, since it has to be embedded into every

aspect of the organisation. Nor will a simple purpose statement alone suffice, bearing in mind the well-worn aphorism that "the road to hell is paved with good intentions". For this reason, the ED&I committee's next step will be to look at the organisation wholistically with a view to developing an ED&I Action Plan which will encompass the short, mid and long-term actions needed to bring about real and enduring change.

Since the ED&I committee fulfils the role of an advisory committee within IBPSA (i.e. its members do not need to be Directors) it can maintain a diverse composition. This composition is an important pre-requisite in ensuring that multiple viewpoints are heard and to stimulate big picture discussions about the organisation's ED&I priorities. Currently the ED&I committee has four founding members Rob McLeod (Chair), Danielle Monfet, Heba Hassan and Lori McElroy. We would like to take this opportunity to reach out and encourage wider participation, particularly from members who identify with belonging to under-represented groups or affiliates within the organisation. If anyone would like to participate in our future meetings and share the challenges of creating a positive ED&I culture within IBPSA then please feel free to send me an email at mcleod@tugraz.at.

### MOU between IBPSA and IAQVEC signed

Last December, IBPSA signed a Memorandum of Understanding (MOU) with IAQVEC, the Indoor Air Quality, Ventilation and Energy Conservation in Buildings Association. IAQVEC started its activity in 1992 and registered as a non-profit organization in France in 2016. The association covers a wide range of key research areas with the aim of improving indoor environmental quality (IEQ) and energy efficiency, enhancing wellbeing and sustainability. The MOU aims to strengthen the relationship between IAQVEC and IBPSA and to promote substantial and tangible actions to increase the co-operation between the two associations.

For more information about IAQVEC, visit www.iaqvecassociation.org/index.html





### **News from IBPSA affiliates**

IBPSA affiliates are asked to submit a report to the IBPSA Board each year to keep Board members informed about their activities and membership. These are too detailed to include in ibpsaNEWS, so affiliates have been asked to make their latest annual report available through their web sites, and this section includes only selected, recent news. Other news from affiliates may be available from their websites; the URLs for these are available on the IBPSA Central web site at www.ibpsa.org/?page\_id=29.

### **IBPSA-Brazil**

In 2022, the IBPSA-Brazil Chapter is organizing a series of one-hour webinars under the title "Conversando sobre simulação" (in English, "Talking about Simulation") with the following topics:

- 1 The Process of LEED Certification (24 February). Lecturer: Fabiano Ferreira
- 2 Simulation of photovoltaic systems (23 March). Lecturer: Lucas Nascimento
- 3 Model calibration in the simulation of existing buildings (27 April). Lecturer: Alberto Hernandez Neto
- 4 Ground heat transfer simulation (19 May). Lecturer: to be decided
- 5 Simulation of heat recovery systems (9 June). Lecturer: Alberto Hernandez Neto
- 6 Simulation of geothermal cooling (7 July). Lecturer: Alberto Hernandez Neto
- 7 Simulation and the Brazilian Thermal Performance Standard 15575 (11 August). Lecturer: to be decided
- 8 Simulation of VRF systems (9 September). Lecturer: Anderson Letti
- 9 Simulation of central water chilled systems (6 October). Lecturer: Anderson Letti

There are plans to keep organizing such webinars in 2023 as an effort to improve knowledge of building simulation in Brazil. For more details and to watch the seminars held in 2021, go to www.ibpsa.org.br.

### **IBPSA-England**

### Webinar Series 2022

IBPSA-England has been running a live webinar as part of the 2022 series. The webinars aim to present some of the latest knowledge and developments in the area of Building Performance Simulation with speakers from academia and industry discussing some of the simulation and analysis tools and methods used to understand the problems in the built environment. The webinars so far covered in the series include:

- Beyond COP26: The role of BPS towards climate resilient building design
- IBPSA-England / CIBSE BSG Event: Estimating airborne infection through simulation and analysis Part 2
- IBPSA-England Webinar: Co-simulation for advanced building performance assessment

These webinars have been made freely accessible from IBPSA-England's website https://www.ibpsa-england. org and on their YouTube Channel https://www.youtube.com/channel/UClghvmhLdNKnEKE2ohOHENg/ featured .

New events are organised every month and for up-to-date information about them please subscribe to our newsletter at https://www.ibpsa-england.org/join-us and follow us on LinkedIn at https://www.linkedin.com/company/ibpsaengland.



### **IBPSA-India**

IBPSA-India organized the second memorial lecture of Professor N K Bansal on *First Fuel: India's Quest for Decarbonization* on 17 January 2022.

Professor Bansal was the father of building energy simulation in India, and he alone is credited with introducing the use of simulation in teaching, research, and design practice. He was the author and the editor of more than 20 books and more than 300 publications. He has guided more than 35 PhDs and 40 Masters with a number of international students. Professor Bansal was regarded as one of the top 2% of scientists in the world and his research work and projects speak volumes for his extensive contribution to the field of energy.

The lecture was given by Padu Padmanaban, Energy Efficiency Advisor. More than 70 participants including academicians, researchers, policymakers, and building simulation practitioners from India, Germany, the United States, and Canada attended the lecture. Mr. Padmanaban shared his insights and knowledge on decarbonization. He explained the mapping of industrial



decarbonization and shared integrative energy-efficient design principles with examples. The lecture gave insights into the meaning of net-zero and how to achieve decarbonization effectively. An interesting discussion was held on decarbonization pathways, the need to promote the concept of energy productivity, and the requirement for simple simulation tools for decision making such as pump-pipe selection.

The recording of the lecture is available at https://youtu.be/mb99pqq9jgo.

### **Building Performance Analysis**

**Building Performance Analysis** is the go-to resource for those who want to have a deep understanding of what building performance is, before moving on to simulate it. Building Performance Analysis is endorsed by IBPSA.

Obviously, the key topic of the book is building performance. While a lot has been published on the subject of simulation, the application area is often taken for granted within the IBPSA community. Yet to do meaningful simulations, one of the hardest challenges is to define the question that is to be answered. The answer to deep questions about building performance may be gained by simulation, but there are other approaches available as well, especially in the realm of physical measurement. These are also covered in the book; hence the use of the word analysis in the title.

#### **Table of Contents:**

Introduction
 Part I: Foundation

 Building Performance in Context
 Needs, Functions and Requirements
 Part II: Assessment
 Fundamentals of Building Performance
 Ferformance Criteria
 Performance Quantification
 Working with Building Performance
 Part III: Impact
 Building Operation, Control and Management
 High Performance Buildings
 Epilogue
 Emission Theory
 Emission
 Building Operation, Control and Management
 Emission
 Emiss

**Building Performance Analysis** offers a comprehensive and systematic overview of the concept of



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building performance analysis, bringing together many existing notions and ideas in one single title. It consists of three main parts. Part I deals with the foundations of building performance, Part II deals with performance assessment, and Part III with the impact of applying of building performance analysis throughout the building life cycle. The book concludes with an epilogue that presents an emerging theory of building performance analysis. Building Performance Analysis is a substantial book: it has 11

chapters, 600 pages, and includes over 1600 references.

**Building Performance Analysis** is written for the building science community, both from industry and academia. Amongst others, it aims to make the following contributions to the field:

- 1 It reviews the significant body of knowledge on building performance that already exists, offering a point of entry to this complex subject matter for those who are new to the field.
- 2 The book emphasizes the fact that building performance deals with a wide variety of performance aspects. In doing so it challenges the community to address some of the aspects that get less prominence in the literature.
- **3** The book goes beyond simulation as a tool for building performance analysis: it also discusses physical measurement approaches, expert judgment, and stakeholder evaluation. It offers a review of the many analysis approaches available in each of these categories.
- **4** The emergent theory in the epilogue is intended as a key resource for those wishing to do further work in the field and needing to develop research questions and hypotheses. The emergent theory is very much intended as subject matter for discussion, debate, and deeper exploration.

The book has a foreword by Godfried Augenbroe, long-term mentor of the author. The endorsement by IBPSA is written by Malcolm Cook, chair of the IBPSA Publications Committee. Further endorsements stem from colleagues who have helped by reviewing drafts of the work: Georg Suter, Wei Tian, Cheol-Soo Park, Dru Crawley and Ruchi Choudhary.

The book can be purchased directly from the publisher, via the major online retailers, and of course via your local bookseller. For questions and feedback, please email the author at pieter@bldg-perf.org.



August 2020: 372pp 64 illustrations

Hb: 978-0-367-51805-9 | \$155.00 Pb: 978-0-367-51806-6 | \$85.95 eBook: 978-1-003-05527-3

### New from Routledge!

### Fundamentals of Building Performance Simulation

**Ian Beausoleil-Morrison**, Carleton University Ottawa, Ontario, Canada

Fundamentals of Building Performance Simulation pares the theory and practice of a multi-disciplinary field to the essentials for classroom learning and real-world applications. Authored by a veteran educator and researcher, this textbook equips graduate students and emerging and established professionals in architecture and engineering to predict and optimize buildings' energy use. Each subject is introduced without reference to particular modelling tools while problems at the end of each chapter provide hands-on experience with the tools of the reader's choice.

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This new edition provides a unique and comprehensive overview of building performance simulation for the complete building life-cycle from conception to demolition, and from a single building to district level. It contains new chapters on building information modelling, occupant behaviour modelling, urban physics modelling, urban building energy modelling, and renewable energy systems modelling. This new edition keeps the same chapter structure throughout including learning objectives, chapter summaries and assignments. It is primarily intended for building and systems designers and operators,

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Members can subscribe to the IBPSA mail list (and, if desired, unsubscribe or edit) via a web interface which is available at <a href="http://lists.onebuilding.org/listinfo.cgi/bldg-sim-onebuilding.org">http://lists.onebuilding.org/listinfo.cgi/bldg-sim-onebuilding.org</a>. Note that this mailing list is solely for IBPSA-related notices and to ensure that you receive future important IBPSA updates (including the election process and announcements of IBPSA News releases).

For any other purposes, please use the BLDG-SIM list. BLDG-SIM is a mailing list for users of building energy simulation programs worldwide, including weather data and other software support resources. BLDG-SIM is intended to foster the development of a community of those users. Experienced and inexperienced users of building energy simulation programs are welcome and are expected to share their questions and insights about these programs.

If you have any questions with respect to the BLDG-SIM, please contact the list owner: Jason Glazer at jglazer@gard.com or +1 847 698 5686. This list is made possible courtesy of GARD Analytics, Inc., Ridge Park, IL, USA. For further information about this list server, see the web page located at http://lists. onebuilding.org/listinfo.cgi/bldg-sim-onebuilding.org.

### Journal of Building Performance Simulation

Official journal of the International Building Performance Simulation Association (IBPSA)

#### **EDITORS:**

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### **Call for papers**

### Special Issue: multi-domain simulation workflows for 'Sustainable Cities & Communities' (UN SDG11)

This SI intends to showcase examples in which simulation workflows, integrating models from different domains or disciplines, are used to evidence-base, solve conflicts and/or reconcile design solutions towards achieving UN SDG 11 'Sustainable Cities & Communities'. It aims to provoke a more active debate in mitigating the environmental impacts of climate change while building resilient communities, in tune with the UN blueprint to achieve a sustainable future for all.

Topics of interest: Original research in which multi-domain simulation models, with at least one of them falling within JBPS **aims and scope**, were used to evidence-base the design process towards achieving:

- Sustainable neighbourhoods
- Integrated sustainable transport
- Integrated public spaces
- Sustainable & integrated land-use
- Low Carbon districts or neighbourhoods
- Disaster preparedness & post-disaster relief

Full details of the call can be found in: https://bit.ly/3DtvwxZ

### **Important dates**

Abstract submission deadline (300 words to Guest Editors): 30 April 2022 Full-length article submission deadline: 30 November 2022

### **Guest Editors**

Dr. Clarice Bleil de Souza, Welsh School of Architecture, Cardiff University, UK Prof. Lori McElroy, Department of Architecture, University of Strathclyde, UK Dr. Camilla Pezzica, Welsh School of Architecture, Cardiff University, UK

### Articles published since *ibpsa*NEWS 31-2:

Jean-Baptiste Bouvenot, Vincent Jimenez & Lucas Desport (2021) Dynamic thermal behaviour characterization of integrated insulation clay hollow blocks for buildings energy simulations applications, Journal of Building Performance Simulation, 14:5, 515-535

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### Special Issue: Simulation of Occupant-Centric Control for Building Operations

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Muhammad Zeeshan, Zaib Ali & Emad Ud Din (2022) Thermal performance prediction of street trees inside isolated open spaces – evaluations from real scale retrofitting project, Journal of Building Performance Simulation

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