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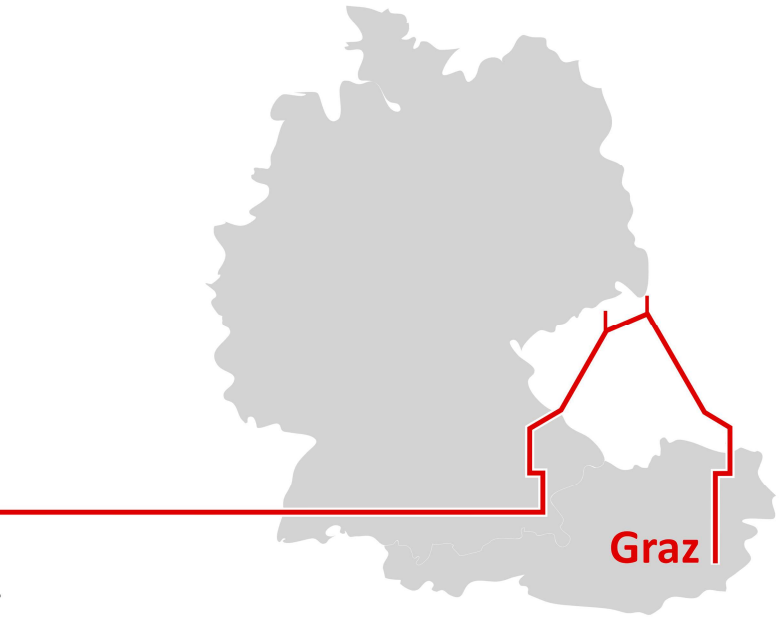
8th Conference of IBPSA Germany and Austria

PROCEEDINGS



BauSIM2020

23-25 September

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8th Conference of IBPSA Germany and Austria

23-25 September 2020, Graz University of Technology, Austria

Proceedings

M. Monsberger, C. J. Hopfe, M. Krüger, A. Passer (Editors)

Institute of Building Construction I Institut für Hochbau

Graz University of Technology

Imprint

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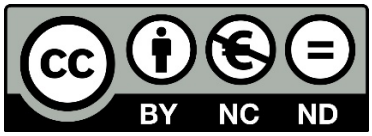
ISBN e-book 978-3-85125-786-1
DOI 10.3217/978-3-85125-786-1



Preface

The Austro- German Chapter of the International Building Performance Simulation Association (IBPSA) has run its biennial conference since 2006. Graz University of Technology (TU Graz) is proud to be hosting the 8th BauSIM conference from 23rd – 25th September 2020, the second such conference to be organized by an Austrian institution.

Every year brings a new adventure and challenge; and sadly 2020 brought a global pandemic that has resulted in much human suffering and has indelibly changed the working and social lives of many of us. As the organizing team of the BauSIM, at the peak of the first wave of this crises, we faced the daunting decision of whether to postpone or to cancel the conference entirely. We did not know whether to err on the side of optimism and hope for the best by organizing an in-person event, or whether a hybrid model or even a virtual conference was more realistic. In the midst of the current second wave that is building across Europe, we are relieved to have opted for the online format and are pleased to be hosting the first ever virtual BauSIM conference.

The term BauSIM is a composite of the German word for building "Bau" and a contraction of the word simulation. In these times of climate crisis and a pandemic, the quality of the built environment comes to the fore. Buildings are a major greenhouse gas contributor and therefor a key factor towards mitigating climate change and biodiversity loss. But this meta-role comes in addition to their more immediate function in terms of issues pertaining to indoor air quality, thermal, acoustical and visual comfort, productivity, and the ability to regulate a buildings' environmental systems. The current pandemic shows more than ever the mutual importance of high quality and high performance building design in support of the health and wellbeing of people and communities. With greater awareness of accelerating global change, we realise that there is still much to do in order to tackle all of the challenges before us. More so when we consider the time-horizon of these challenges in the context of a predominantly static building stock.

The nature of this years' conference has forced us to adapt the format and we have made use of pre-recorded video presentations which will be aired during live interactive sessions throughout the conference. We are delighted to announce two keynote speakers this year, Dr. Ruchi Choudhary from the University of Cambridge, who will deliver a talk on "Digital Twins of the Built Environment" and Dr. Steffen Robbi, who will present "The role of R&D within the digital transformation of the building industry", as well as Dr. Sven Moosberger from EQUA who will give a provocation talk, gleefully (we hope) entitled "time to despair?".

We also have in store a roundtable discussion with leading experts in the field of building performance simulation on the topic of "challenges and future endeavours". Participants for this discussion are Prof. Joe A. Clarke (Professor Emeritus, University of Strathclyde, FIBPSA), Prof. 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), and Mr. Andrew Corney (Product Manager at Trimble - SketchUp and Sefaira, UK; FIBPSA).

This year we received 133 abstracts, which following the abstract review process resulted in 97 full papers being submitted. Of the 80 paper submissions finally accepted, 43% were submitted in German and 57% in English. Hence, this is likely to be the first BauSIM conference, where we will witness more contributions being delivered in English than in German.

In total we have received contributions and registrations from participants from 10 countries (Sweden, Germany, Albania, Austria, Italy, Hungary, Turkey, UK, Switzerland and the US). All of the papers submitted underwent a double-blind peer review process courtesy of our review panel, which comprised of international experts in the domain of building simulation. The standard of the paper contributions as well as the hard work of our scientific committee shine through in our conference proceedings and demonstrate the high quality of research within the IBPSA community, where 9 of the accepted papers will be selected for publication in a special edition of the Bauphysik journal (Wilhelm Ernst & Sohn publishers).

In terms of the subject themes BauSIM 2020 shows the following topical distribution: “tools for building and district simulation” (ca. 30%), “optimization of operation strategy” (ca. 20%), “comfort (thermal, visual, auditory, physiology)” (ca. 20%), “BIM based simulation and tools” (10%), “regenerative, decentralized energy systems” (ca. 5%), “life cycle oriented modelling and simulation of buildings and urban systems” (ca. 5%).

We would like to thank our colleagues at TU Graz without whose sustained efforts this conference would not have been possible. We extend our warmest thanks to our review panel, our scientific conference committee, our session chairs, as well as IBPSA World and SimAUD. A special thank-you goes out to our platinum sponsor EQUA, as well as for the support we have received from the Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology, Land Steiermark, and GreenTech Cluster. And finally we extend our thanks to you, our participants who are at the heart of this conference.

Thank you all for making BauSIM 2020 an event to be proud of at this challenging time.

Michael Monsberger, Christina J. Hopfe, Markus Krüger & Alexander Passer
Graz 2020

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The role of R&D within the digital transformation in the building industry

Dr.-Ing. Steffen Robbi (Innovationslabor „Digital findet Stadt“)

Compared to most other industries, the productivity in the construction and real estate sector has hardly increased over the past 20 years. This is mainly due to a slow introduction of digitisation measures. According to Roland Berger, the construction industry is at the bottom across all sectors when it comes to the level of digitalisation.

A study by PwC from 2018 also confirms: "The people surveyed rate the importance and impact of the digitalisation in the construction industry very highly. Building Information Modelling (BIM) will increase the cost and time efficiency as well as the quality of construction projects in the future. The majority of construction companies have now also recognised the urgency of digitalisation. However, concrete implementation measures are still awaited".

Although many technological innovations are emerging, the high degree of fragmentation and the large number of different companies involved prevent efficient and comprehensive digitalisation. Large companies in the construction industry as well as international corporations from outside the sector have long since recognised this trend and are developing their own solutions, which, however, take little account of the needs and potential of the numerous SMEs, which account for almost 90% of the companies in the sector in Austria.

The slow arrival of digitalisation is therefore primarily a “cultural” problem. Integral work across company, sector and construction phases is a prerequisite for digitalisation and BIM to work out their full potential. All stakeholders involved must communicate in a model-oriented manner, responsibilities must be reorganized and knowledge must be shared with one another.

After the last few years within a steady conversion process, after courageous small steps and initial pilot projects, the construction industry is now facing a major transformation. Internal analogue processes in communication, billing, data exchange, etc. have already been replaced by new digital tools and platforms. At this stage in particular Covid-19 has helped to change peoples minds and habits in the usage of digital communication platforms. IT problems that until recently seemed unsolvable were realized within a very short time. New flexible working environments and habits have already established themselves as a standard in many places.

In the next step of the transformation, we begin to gain comprehensive benefits from the application of digital models and tools. We establish automated, model based mass and quantity calculations, test digital procurement processes, establish open standards in order to enable the introduction of project-accompanying building simulations for quality assurance. We recognize the added value of a cross-phase collaboration and the consistency of data chains from planning to operation.

However, real efficiency advantages arise less from people being replaced by machines or analogue by digital processes. Significant change comes from new business models. In the construction industry, the greatest potential is seen in the use of operating data and in the (partial) automation of construction processes. However, disruption does not necessarily have to result in substitution, but can also lead to synergy and to hybrid business models in which analogue products and digital technologies are combined.

Role of Austrian research

In order to solve the upcoming change phases, not only new digital tools are needed, but a new type of collaboration. We need a powerful vision of what the construction industry of the future should look like. Understanding buildings as spaces for living and work is not just the task of architects and developers. It is important to understand the requirements of users and operators and to develop projects based on them.

Research and development play an essential role within this. R&D projects offer an excellent framework to try out new ideas or technologies and to win interesting companies as future customers or partners.

According to the BMK, research expenditures in the area of built environment (buildings and cities) sum up to around EUR 136 million over the past 20 years. In addition to 650 research projects, around 80 pilot buildings were

constructed in which innovative energy technologies and sustainable construction methods have been demonstrated. With R&D expenditures of only 0.4% based on gross domestic value , Austria only ranks 8th in Europe. Nevertheless, with targeted programs and great innovations, it has been possible to achieve high international recognition in the field of sustainable buildings. For example, the first passive houses in China were developed and implemented by Austrian offices.

Similar efforts must now be made in the field of digitalisation in order to keep Austrian companies internationally competitive and to increase the long-awaited productivity of the construction sector.

However, since the topic of digitalisation ranges from communication platforms to the use of artificial intelligence, from robotics on the construction site and connected sensors, to autonomous driving systems, drones and IoT in operation, a new approach is also required in research. A common vision must form the basis for developing an overarching strategy with defined use cases for digitalisation in order to be able to clearly show the benefits with the greatest added value.

With the help of so-called innovation laboratories, Austria-wide platforms were created, which represent a central point of contact for certain topics. For the digitalisation of the construction industry, the recently founded innovation laboratory Digital Findet Stadt offers a cross-phase platform on which new innovation projects are initiated. Starting with a common vision, ideas are developed towards marketable products and services by use of co-creative methods and tools. Promising research & innovation projects are supported with relevant resources, know-how and access to a comprehensive partner network, thus promoting cross-sector and cross-phase digitalisation - with open BIM as a central element.

Together with its partners, the innovation laboratory Digital Findet Stadt is working on the consistency of processes and data models in order to increase resource, energy and cost efficiency. Digitized processes are the basis for robust risk management and quality assurance across all phases of the life cycle.

An important indicator in the assessment of success will be whether it is possible to activate the “swarm intelligence” of the many SMEs and to stimulate a comprehensive build-up of skills so that Austria remains an innovative, export-oriented and internationally renowned business location for the construction industry.

Dr.-Ing. Steffen Robbi co-founded the innovation lab Digital Findet Stadt, platform for digital innovations in the construction and real estate industry. Previously, he was responsible for Digital Building Technologies as Business Manager and Senior Engineer at the AIT Austrian Institute of Technology. His first experiences in shaping an innovative business model that achieves rapid market growth with sustainable technologies, was at the German start-up and now internationally renowned company Cloud&Heat Technologies.

Digital Twins of the Built Environment

Dr Ruchi Choudhary (Research Group of Digital Twins of Built Environment at the Alan Turing Institute and University of Cambridge)

Dr Ruchi Choudhary is Reader of Architectural Engineering in the Engineering Department at University of Cambridge. She specializes in simulation methods for predicting energy demand of the built environment. She is leading the research group on Digital Twins of Built Environment at the Alan Turing Institute (2018-2021). At Cambridge, she leads the multi-disciplinary Energy Efficient Cities Initiative, initially funded by a Science & Innovation award at Cambridge. She is also co-investigator of the Cambridge Centre for Smart Infrastructure & Construction. Her research spans simulation-based methodologies for energy management of buildings; uncertainty quantification in building simulation models; and multi-disciplinary interactions influencing energy use in cities. She is leading projects on modelling underground heat and city-scale geothermal systems, urban farming, and end-use energy demand modelling. In 2019 she became fellow of the International Building Performance & Simulation Association (IBPSA). She is elected chair of IBPSA-England since 2018. She is on the editorial board of J. of Building Performance Simulation, BSER&T the CIBSE Journal, Sustainable Cities and Society, and ICE J. of Smart Infrastructure & Construction.

Time to Despair?

Dr. Sven Moosberger (EQUA Solutions AG)

Dr. Sven Moosberger is co-founder and co-CEO of EQUA Solutions AG Switzerland. In this role, he has accompanied building performance simulation in the German-speaking world over the past ten years on its way from research to both education and planning practice. His experience ranges from extensive validation studies, model development for product design, development and implementation of training courses to project management of real construction projects in the fileds of both building pyhsics, HVAC engineering and building automation. Today he works intensively on the application of building simulators during operation.