Hensen, J.L.M. 2018. Foreword in: "Wagner ea 2018 Exploring occupant behavior in buildings; methods and challenges", (IEA EBC Annex 66), Springer International Publishing, Switzerland.
http://dx.doi.org/10.1007/978-3-319-61464-9

Foreword

As our knowledge of buildings and the built environment has increased, so has the complexity of optimizing the design and operation of buildings. It is now understood that as well as conforming to the needs of the users, buildings must also be sensitive to many other dynamic processes in the wider built environment. Thus, in addition to the growing understanding of occupant needs and comfort expectations, and the increasing awareness of the correlation between indoor environments and the health, wellbeing and consequent productivity of a building's occupants, other significant factors that must be taken account of include: global climate change; fossil fuel depletion; variable prices for energy sources; and greater flexibility of organizations and the building stocks that they use.

The simultaneous management of these factors is highly complex and demands an integrated approach to both the design and operation of buildings. To deliver robust building designs and effective system solutions capable of conforming to future demands, it is essential to thoughtfully integrate cutting-edge practices from the fields of building construction and services, the available knowledge of ambient environment effects, and the requirements of a building's occupants and the activities they undertake.

One of the most powerful analysis techniques is computational modelling (i.e. creating a computer based representation of a real system) and simulation (i.e. using a model to predict (future) behavior of a real system). This is now routinely used in a wide range of fields including astrophysics, climatology, chemistry, biology, economics and engineering. However, it must be noted that (A) simulation aims to provide a greater understanding of a given system and does not claim to provide definitive answers to questions or solutions to problems; and (B) ensuring the quality of simulation results is often difficult.

In terms of building performance simulation, various uncertainties (weather, occupant behavior, variable energy prices, etc.) hinder the reliability of the predictions made. Thus, the impact of such uncertainties in building performance predictions is a hot topic in current research. Improving the reliability of predictions of building performance is of prime importance if key concepts for the built environment are to be realized, most notably zero-carbon buildings and districts, energy performance contracting, and demand side management.

It is now generally accepted that the energy and comfort performance of buildings is often strongly influenced by the occupants and their behavior. This influence arises from both the presence of occupants and the control actions that they execute to adjust the conditions of the indoor environment (thermal, air quality, light, noise). Whilst significant advances in efficiency have been made in many aspects of building design such as materials, equipment and building envelopes, understanding of the impact of occupant behavior is less developed. Accordingly, research into how best to utilize building performance simulation software to model and predict occupant behavior related effects is getting a lot of attention.

Capably guided by the editors - Andreas Wagner, William O'Brien, and Bing Dong – leading researchers in occupant behavior in buildings describe their research methods and provide insights by discussing the outcomes thereof. Because of the interdisciplinary and challenging nature of the topic, the contributing authors were selected from a wide range of backgrounds – from building physics and sensor technologies to psychology and social sciences.

This book is intended to provide better insight into challenges and methodologies in the study of occupant behavior in buildings. Thus, the aim is to improve and increase experimental work in order to provide a better basis for the modeling of occupant behavior in the future. This in turn will help to improve building simulation programs, aid simulation users (professionals and researchers), and ultimately lead to better building performance.

This book is essential reading for researchers and practitioners aiming to understand and implement occupant behavior modelling for building performance simulation.

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April 2017