Design Energy Simulation For Architects Guide To 3d Graphics

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A Tool for Design Decision Making
An Interface Model for Building Energy Performance Simulation in an Integrated Computer-aided Design Environment
Design in a Simulation Environment
Low Energy Low Carbon Architecture
eWork and eBusiness in Architecture, Engineering and Construction: ECPPM 2016
The MIT Design Advisor
An Investigation Into the Methods to Facilitate Understanding of the Use of Energy Simulation Program by Architects in the Early Design Stage
Building Energy Simulation
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Introduction to Architectural Science
Urban Building Energy Modeling and Retrofit Design as a Means to Inform Effective Public Policy
Modeling, Design, and Optimization of Net-Zero Energy Buildings

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Design Energy Simulation for Architects John Wiley & Sons
Energy modeling or simulation is the practice of using computerized simulation programs to model the energy and environmental performance of an entire building or the systems within a building. Researchers concur that architects should use the energy simulation programs as a potential design decision support tool, especially in the early design stages, where the time and budgetary constraints often preclude the objective performance feedback from engineers and energy simulation experts who regularly perform energy simulation and where such objective performance feedback can have substantial influence on the overall energy and environmental performance of the final building. However, user surveys assessing simulation uptake by architects have shown that energy simulation is rarely employed by architects in practice. A literature review of these surveys indicated design process related, software related, and user related issues responsible for their limited uptake. Of these, very limited research is focused on the user related issues: enhancing

the level of understanding of energy simulation of architects and the ways to facilitate this understanding. The research presented in this thesis proposes the formulation of a simulation tool independent guide to address the user related issue and gives an overview of the topics to be included in this guide. The topics chosen were based on the analysis of the author's experience of a performed test design and the issues identified through literature review of the user surveys. The topics discussed for inclusion in the guide are: an introduction to simulation; defining the simulation scope; selection of energy simulation programs; defining simulation model and performing simulation; quality assurance and program validation; and data analysis and interpretation. Of these, 'defining the simulation scope' was perceived as one of the important topics influencing the modeling and simulation strategy and the selection of energy simulation programs and hence, was further analyzed. A simulation tool independent framework is proposed and developed to facilitate the formulation of the simulation scope. The framework is a visual representation of the inter-relationship between the design inquiries in the early design stage, simulation tasks and the related performance parameters to be simulated by energy simulation programs for deriving decision support for the design inquiries.

Building Performance Simulation for Design and Operation Routledge

Since the appearance of the first edition of 'Energy Simulation in Building Design', the use of computer-based appraisal tools to solve energy design problems within buildings has grown rapidly. A leading figure in this field, Professor Joseph Clarke has updated his book throughout to reflect these latest developments. The book now includes material on combined thermal/lighting and CFD simulation, advanced glazings, indoor air quality and photovoltaic components. This thorough revision means that the book remains the key text on simulation for architects, building engineering consultants and students of building engineering and environmental design of buildings. The book's purpose is to help architects, mechanical & environmental engineers and energy & facility managers to understand and apply the emerging computer methods for options appraisal at the individual building, estate, city, region and national levels. This is achieved by interspersing theoretical derivations relating to simulation within an evolving description of the built environment as a complex system. The premise is that the effective application of any simulation tool requires a thorough understanding of the domain it addresses.

The Architect's Handbook of Professional Practice John Wiley & Sons

In addition to the application of fundamental principles that lead to a structured method for zero carbon design of buildings, this considerably expanded second edition includes new advanced topics on multi-objective optimisation; reverse modelling; reduction of the simulation performance gap; predictive control; nature-inspired emergent simulation leading to sketches that become ‘alive’; and an alternative economics for achieving the sustainability paradigm. The book features student design work from a Master’s programme run by the author, and their design speculation for a human settlement on Mars. Tasks for simple simulation experiments are available for the majority of topics,

providing the material for classroom exercise and giving the reader an easy introduction into the field. Extended new case studies of zero carbon buildings are featured in the book, including schemes from Japan, China, Germany, Denmark and the UK, and provide the reader with an enhanced design toolbox to stimulate their own design thinking.

Energy Modeling in Architectural Design Springer

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 engineering and architecture to predict and optimize buildings' energy use. It employs an innovative pedagogical approach, introducing new concepts and skills through previously mastered ones and deepening understanding of familiar themes by means of new material. Covering topics from indoor airflow to the effects of the weather, the book's 19 chapters empower learners to: Understand the models and assumptions underlying popular BPS tools Compare models, simulations, and modelling tools and make appropriate selections Recognize the effects of modelling choices and input data on simulation predictions And more. Each subject is introduced without reference to particular modelling tools, while practice problems at the end of each chapter provide hands-on experience with the tools of the reader's choice. Curated reading lists orient beginners in a vast, cross-disciplinary literature, and the critical thinking skills stressed throughout prepare them to make contributions of their own. Fundamentals of Building Performance Simulation provides a much-needed resource for new and aspiring members of the building science community.

Design Energy Simulation for Architects MDPI

Providing a complete and in-depth overview of the available knowledge in the area of low energy and low carbon architecture. The scope of this edited book includes several important topics ranging from chapters giving a broad view of the progressing models in ecologically responsible environments to other chapters focussing on recent advances in de

Conceptual Design Energy Analysis Tool (CDEAT) Research & Development John Wiley & Sons

"Energy modeling calculations for urban, complex buildings are most effective during the early design phase. And most analysis takes only four to sixteen hours to get results you can use. This software-agnostic book, which is intended for you to use as a professional architect, shows you how to reduce the energy use of all buildings. Written by a practicing architect who specializes in energy modeling, the book includes case studies of net-zero buildings, of Living Building Challenge-certified buildings, as well as of projects with less lofty goals to demonstrate how energy simulation has helped designers make early decisions. Within each case study, author Kjell Anderson mentions the software used and other software that could have been used to get similar results so that you learn general concepts without being tied to particular programs. Each chapter builds on the theory from previous chapters, includes a summary of concept-level hand calculations (if applicable), and gives comprehensive explanations with examples. Topics covered include comfort, design energy simulation, climate analysis, master planning,

conceptual design, design development, and existing buildings so that you can create more responsive designs quicker"--

Architectural Energy Efficiency CRC Press

Computing the Environment presents practical workflows and guidance for designers to get feedback on their design using digital design tools on environmental performance. Starting with an extensive state-of-the-art survey of what top international offices are currently using in their design projects, this book presents detailed descriptions of the tools, algorithms, and workflows used and discusses the theories that underlie these methods. Project examples from Transsolar Klimaengineering, Buro Happold´s SMART Group, Behnish Behnisch Architects, Thomas Herzog, Autodesk Research are contextualized with quotes and references to key thinkers in this field such as Eric Winsberg, Andrew Marsh, Michelle Addington and Ali Malkawi.

Design and Construction of High-performance Homes Routledge

This book results from a Special Issue related to the latest progress in the thermodynamics of machines systems and processes since the premonitory work of Carnot. Carnot invented his famous cycle and generalized the efficiency concept for thermo-mechanical engines. Since that time, research progressed from the equilibrium approach to the irreversible situation that represents the general case. This book illustrates the present state-of-the-art advances after one or two centuries of consideration regarding applications and fundamental aspects. The research is moving fast in the direction of economic and environmental aspects. This will probably continue during the coming years. This book mainly highlights the recent focus on the maximum power of engines, as well as the corresponding first law efficiency upper bounds.

Computing the Environment CRC Press

With the increasing interest in energy efficient building design, whole building energy simulation programs are increasingly employed in the design process to help architects and engineers determine which design alternatives save energy and are cost effective. DOE-2 is one of the most popular programs used by the building energy simulation community. eQUEST is a powerful graphic user interface for the DOE-2 engine. EnergyPlus is the newest generation simulation program under development by the U.S. Department of Energy which adds new modeling features beyond the DOE-2's capability. The new modeling capabilities of EnergyPlus make it possible to model new and complex building technologies which cannot be modeled by other whole building energy simulation programs. On the other hand, EnergyPlus models, especially with a large number of zones, run much slower than those of eQUEST. Both eQUEST and EnergyPlus offer their own set of advantages and disadvantages. The choice of which building simulation program should be used might vary in each case. The purpose of this thesis is to investigate the potential of both the programs to do the whole building energy analysis and compare the results with the actual building energy performance. For this purpose the energy simulation of a fully functional building is done in eQUEST and EnergyPlus and the results were compared with utility data of the building to identify the degree of closeness with which simulation results match with the actual heat and energy flows in building. It was observed in this study that eQUEST is easy to use and quick in producing results that would especially help in the taking critical decisions during the

design phase. On the other hand EnergyPlus aids in modeling complex systems, producing more accurate results, but consumes more time. The choice of simulation program might change depending on the usability and applicability of the program to our need in different phases of a building's lifecycle. Therefore, it makes sense if a common front end is designed for both these simulation programs thereby allowing the user to select either the DOE-2.2 engine or the EnergyPlus engine based upon the need in each particular case.

The Integration of Architectural Design and Energy Modelling Software John Wiley & Sons

Now in its third edition, this book provides the ideal and only reference to the physical basis of architectural design. Fully updated and expanded throughout, the book provides the data required for architects to design buildings that will maintain the users comfort in a variety of conditions, with minimal reliance on energy intensive methods like air conditioning. This is not a ‘how to’ book but answers the question why. It equips the reader with the tools to realize the full potential of the good intentions of sustainable, bioclimatic design. All sections have been revised and updated for this third edition including all the most relevant developments affecting heat, light and sound controls. The book responds to the need of understanding beyond ‘rules of thumb’.

Energy Simulation in Building Design John Wiley & Sons

Building energy design is currently going through a period of major changes. One key factor of this is the adoption of net-zero energy as a long term goal for new buildings in most developed countries. To achieve this goal a lot of research is needed to accumulate knowledge and to utilize it in practical applications. In this book, accomplished international experts present advanced modeling techniques as well as in-depth case studies in order to aid designers in optimally using simulation tools for net-zero energy building design. The strategies and technologies discussed in this book are, however, also applicable for the design of energy-plus buildings. This book was facilitated by International Energy Agency's Solar Heating and Cooling (SHC) Programs and the Energy in Buildings and Communities (EBC) Programs through the joint SHC Task 40/EBC Annex 52: Towards Net Zero Energy Solar Buildings R&D collaboration. After presenting the fundamental concepts, design strategies, and technologies required to achieve net-zero energy in buildings, the book discusses different design processes and tools to support the design of net-zero energy buildings (NZEBs). A substantial chapter reports on four diverse NZEBs that have been operating for at least two years. These case studies are extremely high quality because they all have high resolution measured data and the authors were intimately involved in all of them from conception to operating. By comparing the projections made using the respective design tools with the actual performance data, successful (and unsuccessful) design techniques and processes, design and simulation tools, and technologies are identified. Written by both academics and practitioners (building designers) and by North Americans as well as Europeans, this book provides a very broad perspective. It includes a detailed description of design processes and a list of appropriate tools for each design phase, plus methods for parametric analysis and mathematical optimization. It is a guideline for building designers that draws from both the profound theoretical background and

the vast practical experience of the authors.

Prototype Commercial Buildings for Energy and Sustainability Assessment Aia Press

This book is a guide to a sustainable design process that moves from theory, to site and energy use, to building systems, and finally to evaluation and case studies, so you can integrate design and technology for effective sustainable building. Kuppaswamy Iyengar shows you how to get it right the first time, use free energy systems, and utilise technologies that minimize fossil fuel use. Each chapter has a sustainable design overview, technical details and strategies marked by clear sections, a summary, and further resources. Heavily illustrated with charts, tables, drawings, photographs, and case studies, the book shows technologies and concepts integrated into cohesive project types, from small and large office spaces to single and multiuse residences, hospitals, schools, restaurants, and warehouses to demonstrate implementing your designs to meet clients' needs now and for the future. Includes an overview of alternate assessment and evaluation systems such as BREEAM, CASBEE, GBTool, Green Globes alongside LEED, ECOTECT, energy 10, HEED and eQuest simulation programs. The guide reveals the importance of the building envelope—walls, superstructure, insulation, windows, floors, roofs, and building materials—on the environmental impact of a building, and has a section on site systems examining site selection, landscape design, thermal impact, and building placement.

Computing the Environment Routledge

This textbook teaches the fundamentals of building energy modeling and analysis using open source example applications built with the US DOE’s OpenStudio modeling platform and EnergyPlus simulation engine. Designed by researchers at US National Laboratories to support a new generation of high performance buildings, EnergyPlus and OpenStudio are revolutionizing how building energy modeling is taught in universities and applied by professional architects and engineers around the world. The authors, all researchers at National Renewable Energy Laboratory and members of the OpenStudio software development team, present modeling concepts using open source software that may be generally applied using a variety of software tools commonly used by design professionals. The book also discusses modeling process automation in the context of OpenStudio Measures—small self-contained scripts that can transform energy models and their data—to save time and effort. They illustrate key concepts through a sophisticated example problem that evolves in complexity throughout the book. The text also examines advanced topics including daylighting, parametric analysis, uncertainty analysis, design optimization, and model calibration. Building Energy Modeling with OpenStudio teaches students to become sophisticated modelers rather than simply proficient software users. It supports undergraduate and graduate building energy courses in Architecture, and in Mechanical, Civil, Architectural, and Sustainability Engineering.

Designing Zero Carbon Buildings Using Dynamic Simulation Methods John Wiley & Sons

eWork and eBusiness in Architecture, Engineering and Construction 2018 collects the papers presented at the 12th European Conference on Product and Process Modelling (ECPPM

2018, Copenhagen, 12-14 September 2018). The contributions cover complementary thematic areas that hold great promise towards the advancement of research and technological development in the modelling of complex engineering systems, encompassing a substantial number of high quality contributions on a large spectrum of topics pertaining to ICT deployment instances in AEC/FM, including: • Information and Knowledge Management • Construction Management • Description Logics and Ontology Application in AEC • Risk Management • 5D/nD Modelling, Simulation and Augmented Reality • Infrastructure Condition Assessment • Standardization of Data Structures • Regulatory and Legal Aspects • Multi-Model and distributed Data Management • System Identification • Industrilized Production, Smart Products and Services • Interoperability • Smart Cities • Sustainable Buildings and Urban Environments • Collaboration and Teamwork • BIM Implementation and Deployment • Building Performance Simulation • Intelligent Catalogues and Services eWork and eBusiness in Architecture, Engineering and Construction 2018 represents a rich and comprehensive resource for academics and researchers working in the interdisciplinary areas of information technology applications in architecture, engineering and construction. In the last two decades, the biennial ECPPM (European Conference on Product and Process Modelling) conference series, as the oldest BIM conference, has provided a unique platform for the presentation and discussion of the most recent advances with regard to the ICT (Information and Communication Technology) applications in the AEC/FM (Architecture, Engineering, Construction and Facilities Management) domains.

Assessing the Performance of Passive Houses in Mediterranean Climate Regions Presses univ. de Louvain

Energy efficiency requirements in current commercial building energy codes vary across states, and most states have not yet adopted the newest energy standards. Energy standards currently adopted by states range across all editions of ASHRAE 90.1 (-1999, -2001, -2004, and -2007). Some states do not have a code requirement for energy efficiency, leaving it up to the locality or jurisdiction to set their own requirements. The Applied Economics Office in NIST's Engineering Laboratory has developed an extensive database that allows energy efficiency and sustainability comparisons of alternative building designs based on different editions of ASHRAE Standard 90.1. The expansive database is a compilation of multiple data sources, including results from 13 680 whole building energy simulations for 12 commercial building types in 228 cities across all U.S. states, building construction cost databases, energy cost data collected from the Energy Information Administration, and emissions data collected from the Environmental Protection Agency. This report documents the whole building energy simulation designs for the prototype commercial buildings used in this building energy efficiency and sustainability database.

A BIM-based Workflow Concurrently Generating Quantitative and Qualitative Output Universitätsverlag der TU Berlin

The second edition of Building Energy Simulation includes studies of various components and systems of buildings and their effect on energy consumption, with the help of DesignBuilderTM, a front-end for the EnergyPlus simulation engine, supported by examples and exercises. The book employs a "learning by doing"

methodology. It explains simulation-input parameters and how-to-do analysis of the simulation output, in the process explaining building physics and energy simulation. Divided into three sections, it covers the fundamentals of energy simulation followed by advanced topics in energy simulation and simulation for compliance with building codes and detailed case studies for comprehensive building energy simulation. Features: Focuses on learning building energy simulation while being interactive through examples and exercises. Explains the building physics and the science behind the energy performance of buildings. Encourages an integrated design approach by explaining the interactions between various building systems and their effect on energy performance of building. Discusses a how-to model for building energy code compliance including three projects to practice whole building simulation. Provides hands-on training of building energy simulation tools: DesignBuilderTM and EnergyPlus. Includes practical projects problems, appendices and CAD files in the e-resources section. Building Energy Simulation is intended for students and researchers in building energy courses, energy simulation professionals, and architects.
Taylor & Francis
Energy saving in buildings through cost and energy-intensive measures, such as the application of additional building materials and technologies, is only possible with a great consumption of resources and CO2 emissions for their production. For low energy buildings, the investment costs, including user costs and governmental subsidies, are generally high, and construction is not always economically viable in consideration of the national capital in the present economic conditions of most countries. For these reasons, it is first of all necessary to apply cost and resource-efficient measures to save energy in buildings and then make use of additional cost and energy-intensive measures by improving the thermal envelope, the HVAC system or by installing energy generating systems. One of the most cost effective and ecological methods of energy saving in buildings is the reduction of energy requirements through climate responsive architecture. Due to the fact that energy saving through the optimization of architecture is not only cost-neutral, resource-efficient and carbon-neutral but also has a very high energy-saving potential, the first and most important strategy to save energy should be an optimized and climate responsive design. Energy saving through optimized architectural design is economically and ecologically sustainable. The development of building simulation science in the last decades has made it easier to study the energy performance of buildings. Tools have made it possible to predict the complex behavior of buildings regarding the climate. Except for the comparison of different building typologies to find the most efficient, there are no other methods to achieve energy savings through the architectural design, which can be applied by a variety of building types and climates. Therefore, in order to encourage the optimization of architectural design, it is necessary to improve these methods which represent strategies to significantly reduce the energy demand of buildings. Architectural Energy Efficiency is a parametric method which separately studies the effects of various energy-related architectural factors on the energy demand of buildings by using dynamic energy simulations to find the, from an energy efficiency point of view, optimum value for each of these. The architectural

factors include orientation, building elongation, building form, opening ratio in different orientations, sun shading, natural ventilation etc. The research process that led to the formulation of the Architectural Energy Efficiency method is based on a series of simulations carried out by a dynamic simulation software tool (DesignBuilder) to calculate the energy demands of a building with different variants for a single architectural feature. The aim of the simulations is to find an optimum set of energy-related variables that result in the best and most efficient energy performance for a specific building type and climate. This method of efficiency illustrates the effects different architectural features have on the various energy demands of buildings. The criteria are derived from the application of this method for a specific building occupation and climate, and can be applied in the design process of buildings, which leads to improvements of the energy performance and a reduction of resource consumption. As the architectural design affects the heating and cooling as well as the lighting energy demands of buildings, the optimum value of each factor must be based on these three aspects. The heating, cooling and lighting energy demands of buildings all behave very differently. Therefore, these three energy demands together (i. e. the sum of heating, cooling and lighting energy) must also be applied as a criterion to study the building energy performance and find the optimum value for each architectural feature. The criteria for selecting the best variant can not only be based on the total energy demand, but should also consider the primary energy demand, the CO2 emissions, energy costs (for heating, cooling and lighting), life cycle costs, etc. The application of these findings to the architectural design of buildings minimizes the energy demand, the CO2 emissions and energy costs of the building, does not, however, affect the initial building costs. The advantages of energy saving through optimizing the architectural design are not only the improvement of the building’s energy performance, but also the fact that the energy saving is cost and resource-efficient. This means that the energy demand of a building will decrease without increasing the investment costs of the building and without consuming any resources and energy for the production of additional building materials. The cost and resource efficiency contributes towards the economic and ecological sustainability of a building during the full life cycle.

Development of an Open Source Hourly Building Energy Modeling Software Tool CRC Press

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Green BIM CRC Press

Residential buildings use upwards of 20% of the total energy consumed annually in the United States. This, coupled with the desire to reduce overall utility costs and improve occupant comfort on the part of residents, places cities, as the main catalyst for local energy policy, at the forefront of the drive for a more sustainable built environment. This thesis seeks to explore the potential savings associated with energy retrofits in selected neighborhoods in the city of Boston, by developing a comprehensive urban energy model and implementing two retrofit strategies. As part of the methodology, this thesis will combine GIS data with building construction, use, and equipment data to develop a quick, accurate, and adaptable energy simulation model. By combining the findings of the simulation

with socio-economic indicators such as income level and ownership type, this thesis will examine how to best implement the selected building retrofit strategies. Of particular interest, is the idea of an annual adoption rate for a particular strategy and the perceived effects of socio-economic indicators on the actual adoption. Ultimately, the findings of this thesis will enable a thoughtful discussion of the effective implementation of public policy and serve as a guide for further investigations focusing on the demographics of urban energy use.