Table of Contents

Real-Time Resolution of Conflicting Objectives in Building Energy Management: An Utopia-Tracking Approach 1
Victor M. Zavala

A Two-Stage Simulation-Based On-Line Optimization Scheme for HVAC Demand Response 9
Jianmin Zhu; Ling Shen; Rongxin Yin; Yan Lu

Multi-Objective Optimization Model for Building Retrofit Strategies 17
Ehsan Asadi; Manuel Gameiro da Silva; Carlos Henggeler Antunes; Luís Dias

Mapping HVAC Systems for Simulation in EnergyPlus 25
Mangesh Basarkar; James O'donnell; Philip Haves; Kevin Settlemyre; Tobias Maile

Development of a Flexible, Multizone, Multifamily Building Simulation Model 32
Mini Malhotra; Piljae Im

Creating Zoning Approximations to Building Energy Models Using the Koopman Operator 40
Michael Georgescu; Bryan Eisenhower; Igor Mezić

An Investigation to Optimize the Mechanical Systems to Meet Comfort Criteria in a Large Atrium 48
Eshagh Yazdanshenas; Annie Marston; Oliver Baumann

Towards Better Modeling of Residential Thermostats 56
Bryan Urban; Diana Elliott; Olga Sachs

Application of a Stochastic Window Use Model in EnergyPlus 63
Spencer Dutton Hui Zhang Yongchao Zhai Ed Arens Youness Bennani Smires Sam Brunswick Kyle Konis Phil Haves

Window-Wall Interface Correction Factors: Thermal Modeling of Integrated Fenestration and Opaque Envelope Systems for Improved Prediction of Energy Use 71
Mahabir Bhandari; Ravi Srinivasan

Virtual Mock-Up Modeling as Study Model of Building Envelope Performance and Design 75
Minjung Maing

Thermal Performance of Three-Dimensional Building Envelope Assemblies and Details for Improving the Accuracy of Whole Building Performance Simulation 83
Christian Cianfrone; Neil Norris; Patrick Roppel; Medgar Marceau

The Database of Egyptian Building Envelopes (DEBE): A Database for Building Energy Simulations 96
Shady Attia; Omar Wanas

Swimming Pool Hall HVAC Modelling, Simulation and End of Setback Neural Network Prediction: A Detailed Case Study 104
Raymond Sterling Garay Andrea Costa Thomas Messervey Christian Mastrodonato Marcus M. Keane

Control-Oriented Dynamic Modeling and Calibration of a Campus Theater Using Modelica 112
Bryan Eisenhower; Kazimir Gasljevic; Igor Mezić

Practical Techniques for Automated Calibration of Existing Models for Use in Building Operations 120
Madhav Munshi; Dan Tuhus-Dubrow; John An; Brian Coffey; Atelier Ten

Comparison of Two Different Simulation Programs While Calibrating the Same Building 128
Sukreet Singh; Andrea Martinez; Karen Kensek; Marc Schiler

Comparative Analysis of Air-to-Air Heat Pump Models for Building Energy Simulation 136
Hubert Blervaque; Pascal Stabat; Sila Filfli; Cristian Muresan; Dominique Marchio
An Evaluation of the Effectiveness of Pre-Cooling in a Hybrid Ground Source Heat Pump 144
A. J. Pertzborn; G. F. Nellis; S. A. Klein
Feasibility of Combined Solar/Heat Pump Systems for Reduced Residential Conditioning Energy Consumption 152
Greg Marsicek; Sanford Klein; Greg Nellis
The Energy Saving Potential of Membrane-Based Enthalpy Recovery in VAV Systems for Commercial Office Buildings 160
Liping Wang; Philip Haves; John Breshears
Zonal Approach to Modeling Thermally Stratified Atria 168
Timothy C. Moore; Peter J. Ouzts
Streamlined Multizone Model Creation 177
Jason W. Degraw; William P. Bahnfleth; Amy Musser
Application of a Natural Ventilation System Design Tool to a School Building 185
Steven J Emmerich; W. Stuart Dols; Brian Polidoro
Wind-Driven Natural Ventilation in a Low-Rise Building: A Numerical and Experimetnal Study 193
Girma Bitsuamlak; Ashkan Rasouli
Assessing Thermal Bridges in Commercial Wall Systems 201
Andrea Love
A Parametric Study of the Thermal Performance of Double Skin Facades at Different Climates Using Annual Energy Simulation 211
Emir Aykut Pekdemir; Ralph T. Muehleisen
Conduction Transfer Functions in TRNSYS Multizone Building Model: Current Implementation, Limitations and Possible Improvements 219
Benoit Delcroix; Michaël Kummert; Ahmed Daoud; Marion Hiller
Passivhaus and Net Zero Energy Residential Designs in a Cold Climate: A Simulation Based Design Process for the Next Generation of Green Homes 227
Mahdokht Soltaniehha; Jon A. Gardzelewski; Gang Tan; Anthony Denzer
Prediction of the Urban Heat Island Effect to Be Used in Building Energy Analyses 236
Bruno Bueno; Leslie Norford; Julia Hidalgo; Grégoire Pigeon
A GIS-Based Assessment Method for Mean Radiant Temperature in Dense Urban Areas 246
Jianxiang Huang; Jose Guillermo Cedeño Laurent; John Spengler; Christoph Reinhart
Generative Urban Modeling: A Design Work Flow for Walkability-Optimized Cities 255
Tarek Rakha; Christoph Reinhart
Environment Mapping for Fast and Robust Calculation of Indirect Radiant Energy 263
Lars Schumann; Donald P. Greenberg
Autotune E+ Building Energy Models 270
Joshua New; Jibonananda Sanyal; Mahabir Bhandari; Som Shrestha
Thermal and Mechanical Systems Descriptors for Simplified Energy Use Evaluation of Canadian Houses 279
Anil Parekh; Chris Kirney
An Interactive Workbench for Monitoring, Identification and Calibration of Building Energy Models 287
Pavel Dybskiy; Russell Richman

Estimation of Thermal Parameters of Buildings Through Inverse Modeling and Clustering for a Portfolio of Buildings 295
Lianjun An; Raya Horesh; Young T. Chae; Young M. Lee
A Framework for Estimating the Potential Energy Savings of Natural Ventilation Retrofits for California Commercial Buildings 306
Sam Brunswick; Spencer Dutton; David Banks; Kyle Adams; Phil Haves
Annual Coupled EnergyPlus and Computational Fluid Dynamics Simulation of Natural Ventilation 314
Rui Zhang; Khee Poh Lam; Shi-Chune Yao; Yongjie Zhang
Using CFD Simulations to Improve the Modeling of Window Discharge Coefficients 322
Erin L. Hult; Gianluca Iaccarino; Martin Fischer
Coupled EnergyPlus and Computational Fluid Dynamics Natural Ventilation Simulation 329
Rui Zhang; Khee Poh Lam; Shi-Chune Yao; Yongjie Zhang
A New Climate & Hourly Data Delivery System Providing Global Support for Precision Modeling and Control 337
John L Keller; Charles A Khuen
A Framework for Generating Stochastic Meteorological Years for Risk-Conscious Design of Buildings 345
Benjamin D. Lee Yuming Sun Huafen Hu Godfried Augenbroe Christiaan J. J. Paredis
Simulating Naturally Ventilated Buildings with Detailed CFD-Based Wind Pressure Database 353
Bing Wang; Timur Dogan; Debashree Pal; Christoph Reinhart
Tilted Glazing in Building Simulations and Its Effect on Form-Refinement of Complex Facades 361
Won Hee Ko; Marc Schiler; Karen Kensek; Peter Simmonds
Scripted Building Energy Modeling and Analysis 369
Elaine Hale; Daniel Macumber; Kyle Benne; David Goldwasser
New Methods for the Construction and Interpretation of High Dimensional Parametric Building Energy Models 377
David E. Bosworth; Kevin B. Pratt
All the Ways of Meeting a Target: Calculating a Solution Surface Using GenOpt 385
Brian Coffey; Dan Tuhus-Dubrow; Madhav Munshi
Optimization of Typical US HVAC Systems Through Improved Controls 390
Chen Luo; Annie Marston; Oliver Baumann
Modeling HVAC Optimization Control Strategies for High Performance Buildings 400
Patrick Wilkinson; Chris Olmsted
On Inter-Model Comparison Exercises of Whole Building Ham Simulation Using the BESTEST Building 406
Daniel Cóstola; Bert J. E. Blocken; Jan L. M. Hensen
A Systematic Approach to Hygrothermal Modeling and Compliance with Failure Criteria Using WUFI 414
Pallavi Mantha; Lois B. Arena
Proposed TRNSYS Model for Storage Tank with Encapsulated Phase Change Materials 423
Katherine D'avignon; Michaël Kummert
Numerical Thermal Performance Analysis of PCMs Integrated with Residential Attics 431
Ali Fallahi; Nitin Shukla; Jan Kosny

Fault Diagnosis in HVAC Systems Based on the Heat Flow Model 440
Alexander Schiendorfer; Gerhard Zimmermann; Yan Lu; George Lo
An Integrated Infrastructure for Real-Time Building Energy Modeling and Fault Detection and Diagnostics 448
Bing Dong Zheng O'Neill ZhengWei Li Dong Luo Shashanka Madhusudana Sunil Ahuja Trevor Bailey
Efficient and Robust Training Methodology for Inverse Building Modeling 456
Jie Cai; James E. Braun
Continuous Commisioning Based on Extended Fault Detection and Diagnosis 462
Gerhard Zimmermann; Yan Lu; George Lo
Building Performance Metrics Calculation and Visualization for K-12 School Buildings in New York City 470
Young M. Lee; Fei Liu; Estepan Meliksetian; Jane Snowdon; Michael Bobker
Reality Impacts Energy Use: From Dream Time to Real Time for SimBuild 2012 Conference 476
Jason Steinbock Jim Douglas Julia Gauthier Chris Iacono Adam Niederloh David Eijadi
A Process For, and Results From, Whole Campus Energy Conservation by Statistical Extrapolation of Calibrated Energy Models 484
Matthew Brugman; Paul Erickson
Energy and Cost Savings of Retro-Commissioning and Retrofit Measures for Large Office Buildings 496
Weimin Wang; Jian Zhang; Dave Moser; Guopeng Liu; Rahul Athalye; Bing Liu
The Renovation and Rehabilitation of Historic Building Envelopes: An In-depth Building Performance and Thermal Comfort Analysis 504
Thomas Zakrzewski
Scalable Methodology for Energy Efficiency Retrofit Decision Analysis 513
Yeonsook Heo Fei Zhao Sang Hoon Lee Yuming Sun Jinsol Kim Godfried Augenbroe Diane Graziano Leah B. Guzowski Ralph T. Muehleisen
A Demonstration of the Run-Time Coupling Between Esp-R and TRNSYS 521
Francesca Macdonald Romain Jost Ian Beausoleil-Morrison Michaël Kummert Timothy McDowell Alex Ferguson
Validation of the Window Model of the Modelica Buildings Library 529
Thierry Stephane Nouidui; Michael Wetter; Wangda Zuo
Comparison of EnergyPlus and DOE-2 Detailed Window Heat Transfer Models 537
Neal Kruis; Chuck Booten; Craig Christensen
Prioritizing Building System Energy Failure Modes Using Whole Building Energy Simulation 545
Kevin Otto Bryan Eisenhower Zheng O'Neill Shui Yuan Igor Mezic Satish Narayanan
Reduced-Order Building Modeling for Application to Model-Based Predictive Control 554
Donghun Kim; James E. Braun
Automatic Model Reduction in Architecture: A Window into Building Thermal Structure 562
Justin Dobbs; Brandon M. Hencey
Reduced-Order Modeling for Control of Indoor Building Airflows 569
Sunil Ahuja; Eugene Cliff; Satish Narayanan

The Impact of Systems Integration on the Daylighting Performance of Skylights in Offices 577
Ladan Ghobad; Wayne Place; Jianxin Hu
Challenges to Integrated Daylighting and Electric Lighting Simulation Methods in a Whole-Building Energy Simulation Context 585
Rob Guglielmetti; Jennifer Scheib
Hardware Accelerated Computation of Direct Solar Radiation Through Transparent Shades and Screens 595
Nathaniel L. Jones; Donald P. Greenberg
Evaluating the Impact of Shading Devices on the Indoor Thermal Comfort of Residential Buildings in Egypt 603
Ahmed A. M. Ali; Tarek M. F. Ahmed
Urban Daylight Simulation Calculating the Daylit Area of Urban Designs 613
Timur Dogan; Christoph Reinhart; Panagiotis Michalatos
Performance Modeling for a Sustainable Master Plan 621
Krista Raines
Towards Validated Urban Photovoltaic Potential and Solar Radiation Maps Based on LiDAR Measurements, GIS Data, and Hourly DAYSIM Simulations 628
J. Alstan Jakubiec; Christoph F. Reinhart
Preliminary Evaluation of a Daylight Performance Indicator for Urban Analysis: Facade Vertical Daylight Factor per Unit Floor Area 638
Ji Zhang Chye Kiang Heng Lai Choo Malone-Lee Yi Chun Huang Patrick Janssen Daniel Jun Chung Hii Ibrahim Nazim
An Improved Simple Chilled Water Cooling Coil Model 647
Liping Wang; Philip Haves; Fred Buhl
Issues Arising from the Use of Chilled Beams in Energy Models 655
Fred Betz; James Mcneill; Bill Talbert; Harshana Thimmanna; Norbert Repka
A Review of How Different Energy Analysis Tools Address Ventilation in Complex VAV HVAC Systems 668
Andrew Corney; Simon Gardiner; Connor Jansen
Influence of Design and Operating Conditions on Underfloor Air Distribution (UFAD) System Performance 676
Tom Webster Tyler Hoyt Edwin Lee Allan Daly Dove Feng Fred Bauman Stefano Schiavon Kwang Ho Lee Wilmer Pasut Dan Fisher
Cost-Effective Recommendations for 15% Above Code Energy Efficiency Measures Based on the ASHRAE 90.1-2007 for Small Office Buildings in Texas 684
Hyojin Kim; Juan-Carlos Baltazar; Jeff Haberl
Capital Costs and Energy Savings Achieved by Energy Conservation Measures for Office Buildings in the Greater Philadelhia Region 692
Liam Hendricken; Kevin Otto; Jin Wen; Patrick Gurian; William Sisson
Building Envelope Optimazation Method and Application to Three House Types in a Proposed Solar District Energy System 707
Chris Kirney; Anil Parekh; Keith Paget
Application of Integrated Building Simulation and CFD to a Classroom Heating Case Study in a Mediterranean Climate 715
Miguel A. Campano; Samuel Domínguez; Jesica Fernández-Agüera; Juan J. Sendra