

# **10th Symposium on Simulation for Architecture and Urban Design (SimAUD 2019)**

Simulation Series Volume 51 #8

Atlanta, Georgia, USA  
7-9 April 2019

## **Editors:**

**Siobhan Rockcastle  
Tarek Rakha  
Carlos Cerezo Davila**

**Dimitris Papanikolaou  
Tea Zakula**

ISBN: 978-1-7138-0460-4

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571  
[www.proceedings.com](http://www.proceedings.com)



Some format issues inherent in the e-media version may also appear in this print version.

**© 2019 SIMULATION COUNCILS, INC.**

Responsibility for the accuracy of all statement in each paper rests solely with the author(s). Statements are not necessarily representative of, nor endorsed by, The Society for Modeling and Simulation International.

Printed with permission by Curran Associates, Inc. (2020)

Permission is granted to photocopy portions of this publication for personal use and for the use of students provided credit is given to the conference and publication. Permission does not extend to other types of reproduction nor to copying for incorporation into commercial advertising nor for any other profit-making purpose. Other publications are encouraged to include 300- to 500-word abstracts or excerpts from any paper contained in this book, provided credits are given to the author and the conference. For permission to publish a complete paper write: The Society for Modeling and Simulation International (SCS), 2598 Fortune Way, Suite I, San Diego, CA 92081, USA.

**Additional copies of the Proceedings are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571  
[curran@proceedings.com](mailto:curran@proceedings.com)  
[www.proceedings.com/0128.html](http://www.proceedings.com/0128.html)

or

The Society for Modeling  
and Simulation International  
11315 Rancho Bernardo Road, Suite 139  
San Diego, CA 92127 USA  
[www.scs.org](http://www.scs.org)

ISBN: 978-1-7138-0460-4  
PRINTED IN THE UNITED STATES

# Contents

**Experiential Climates** ..... **1**

Sun and Wind: Integrated Environmental Performance Analysis for Building and Pedestrian Comfort . . . . . 3  
*Francesco De Luca*

A Parametric Workflow to Conceive Facades as Indoor and Outdoor Climate Givers. . . . . 11  
*Emanuele Naboni, Eric Danzo and Luca Ofria*

Streets, Parks & Plazas: Analyzing Daylight in the Public Realm . . . . . 19  
*Elizabeth de Regt and Tomothy Deak*

**Retrofitting Analysis** ..... **27**

Unleashing the Diversity of Conceptual Building Renovation Design: Integrating High-Fidelity Simulation with Rapid Constraint-Based Scenario Generation . . . . . 29  
*Aliakbar Kamari, Carl Peter Leslie Schultz and Poul Henning Kirkegaard*

Application of Surrogate Modeling to Multi-Objective Optimization for Residential Retrofit Design . . . . . 37  
*Arfa N. Aijazi and Leon Glicksman*

Aerial Thermography as a Tool to Inform Building Envelope Simulation Models . . . . . 45  
*Norhan Bayomi, Shreshth Nagpal, Tarek Rakha, Christoph Reinhart and John Fernandez*

**Data in Mixed Realities** ..... **49**

Towards Assembly Information Modeling (AIM). . . . . 51  
*Ayoub Lharchi, Mette Ramsgaard Thomsen and Martin Tamke*

Subjective Impressions of a Space Influencing Brightness Satisfaction: an Experimental Study in Virtual Reality . . . . . 57  
*Azadeh Sawyer and Kynthia Chamilothoni*

Immersive Representation of Urban Data . . . . . 65  
*Amber Bartosh and Rongzhu Gu*

## **Modeling Urban Energies . . . . .69**

A Data-driven Framework For Urban Building Operational Energy Use Modeling . . . . .71  
*Narjes Abbasabadi and Rahman Azari*

An Integrated Urban Planning and Simulation Method To Enforce Spatial Resilience  
Towards Flooding Hazards . . . . . 79  
*Julius Morscheke, Reinhard Konig and Sven Schneider*

A Method for Integrating an Ubem with Gis for Spatiotemporal Visualization and Analysis. . 87  
*Bess Krietemeyer and Rawad El Kontar*

A Technique for Developing High-Resolution Residential Occupancy Schedules for  
Urban Energy Models . . . . . 95  
*Diba Malekpour, Farzad Hashem, Vinciane Tabard-Fortecoeuf and Ulrike Passe*

## **Designing Urban Futures . . . . .103**

Environmental Data and Land Use: Integration of  
Site-Specific Ecology and Urban Design . . . . . 105  
*Claudio Campanile and Shih Hsin Wu*

How to Generate a Thousand Master Plans: A Framework for Computational  
Urban Design. . . . . 113  
*Luc Wilson, Jason Danforth, Carlos Cerezo Davila and Dee Harvey*

CityFiction – Scenarios for Densification. . . . . 121  
*Henrik Malm and Petra Jenning*

Exploring Urban Walkability Models and Pedestrian Movement Trends in a  
Vancouver Neighbourhood . . . . . 129  
*Nicholas Martino, Cynthia Girling and Edja Trigueiro*

## **Mediums of Indoor Comfort . . . . .133**

A Simulation-Based Design Analysis for the Assessment of Indoor Comfort Under the  
Effect of Solar Radiation . . . . . 135  
*Andrea Zani, Henry David Richardson, Alberto Tono, Stefano Schiavon and Edward Arens*

Black Globe Free Convection Measurement Error Potentials. . . . . 143  
*Eric Teitelbaum, Jovan Pantelic, Adam Rysanek, Kian Wee Chen and Forrest Meggers*

Assessing the Performance of UFAD System in an Office Building Located In Various Climate Zones . . . . .	147
<i>Roshanak Ashrafi, Mona Azarbayjani, Robert Cox, Benjamin Futrell, Joseph Glass, Amir Zarrabi and Armin Amirazar</i>	
Evaluating the Influence of Three Simplifications on Natural Ventilation Rate Simulation . .	155
<i>Yuchen Shi and Xiaofeg Li</i>	
<b>Simulating People . . . . .</b>	<b>159</b>
Adaptive Occupancy Scheduling: Exploiting Microclimate Variations in Buildings . . . . .	161
<i>Max Marschall and Jane Burry</i>	
Toward a Multi-Level and Multi-Paradigm Platform for Building Occupant Simulation . . . .	169
<i>Davide Schaumann, Seonghyeon Moon, Muhammad Usman, Rhys Goldstein, Simon Breslav, Azam Khan and Mubbasir Kapadia</i>	
Multi-Constrained Authoring of Occupant Behavior Narratives in Architectural Design . . . . .	177
<i>Xun Zhang, Davide Schaumann, Brandon Haworth, Petros Faloutsos and Mubbasir Kapadia</i>	
Including Occupant Behavior in Building Simulation: Comparison of a Deterministic vs. a Stochastic Approach . . . . .	185
<i>Max Marschall, Farhang Tahmasebi and Jane Burry</i>	
<b>Robots that Make . . . . .</b>	<b>189</b>
Rotoform - Realization Of Hollow Construction Elements Through Roto-Forming With Hyper-Elastic Membrane Formwork . . . . .	191
<i>Oliver Tessman and Samim Mehdizadeh</i>	
Environmentally Informed Robotic-Aided Fabrication . . . . .	199
<i>Carmen Cristiana Matiz, Heather “Brick” McMenomy and Elif Erdine</i>	
Curved-Crease Folding and Robotic Incremental Sheet Forming in Design and Fabrication. . . . .	207
<i>Elif Erdine, Antiopi Koranaki, Alican Sungur, Angel Fernando Lara Moreira, Alvaro Lopez Rodriguez, George Jeronimidis, Michael Weinstock</i>	
<b>Performative Structures. . . . .</b>	<b>215</b>
Structural Performance of Semi-Regular Topological Interlocking Assemblies . . . . .	217
<i>Michael Weizmann, Oded Amir and Yasha Jacob Grobman</i>	

Data-driven Material System of Graded Concrete Structures . . . . .	225
<i>Elisabeth Riederer and Anuradha Suryavanshi</i>	
Modularizing Tensegrity Systems: An Approach to Controllable Independent Modules. . . . .	231
<i>Arian Seedfar and Paniz Farrokhsiar</i>	
A Framework for Cost-Optimal Zero-Energy Lightweight Construction . . . . .	239
<i>Mohamed Amer and Shady Attia</i>	
<b>Design Decision Models . . . . .</b>	<b>243</b>
An Automated Framework Creating Parametric BIM from GIS Data to Support Design Decisions. . . . .	245
<i>Chengde Wu, Saied Zarrinmehr, Mohammad Rahmani Asl and Mark J. Clayton</i>	
Digital Energy Performance Signature Extensible Markup Language (DEPSxml): Towards a New Characterization Framework for Sharing Simulation and Measured Data on Building Design and Energy Performance . . . . .	253
<i>Justin McCarty and Adam Rysanek</i>	
From Optimization to Performance-Informed Design . . . . .	261
<i>Thomas Wortmann and Thomas Schroepfer</i>	
Linear and Classification Learner Models for Building Energy Predictions and Predicting Saving Estimations . . . . .	269
<i>Kevin Eaton, Nabil Nassif, Pyria Rai and Alexander Rodrigues</i>	
<b>Geometric Explorations . . . . .</b>	<b>277</b>
From Drawing Shapes to Scripting Shapes: Architectural Theory Mediated by Shape Machine . . . . .	279
<i>Heather Ligler and Athanassios Economou</i>	
Interpreting Non-Flat Surfaces for Walkability Analysis . . . . .	287
<i>Mathew Schwartz and Subhajt Das</i>	
Generating Acoustic Diffuser Arrays with Shape Grammars . . . . .	295
<i>Jonathan Dessi-Olive and Timothy Hsu</i>	
A Unified Framework for Optimizing the Performance of a Kinetic Façade. . . . .	303
<i>Ok-Kyun Im, Kyoung-Hee Kim, Armin Amirazar and Churlu Lim</i>	
<b>Author Index . . . . .</b>	<b>311</b>

<b>Presenting Authors</b> .....	<b>313</b>
<b>Organizing Committee</b> .....	<b>327</b>
<b>Sponsors</b> .....	<b>331</b>