



DESIGN SPACE CONSTRUCTION: GENERATION, SIMULATION AND DATA ANALYSIS

1. Workshop Instructor Information

Name	Marcelo Bernal, Ph.D.
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Short Biography <i>(150 words max.)</i>	Marcelo Bernal holds a Ph.D. in Design Computing from the Georgia Institute of Technology. He has developed his career between the professional practice and the academia. He is founder partner of Arqze Ltd, architectural practice dedicated to the design, fabrication, and installation of mobile deployable infrastructure for Antarctica. He was also the Director of the Undergraduate program at Universidad Técnica Federico Santa María, Chile. Currently, he divides his activities between teaching and applied research as research in his role of Director of the Design Process Lab at Perkins+Will, an international architecture and design firm. The scope of his area of research includes meta-modeling, performance-based design, multi-criteria optimization to support decision-making, and workflows for design automation. As active member of the community, he serves as Vice-President of the Iberoamerican Society of Digital Graphics, SIGraDi, and Editorial Board member of the International Journal of Architectural Computing, IJAC.
Head Shot	

2. Workshop Information

Length	Three Hours
Short Abstract	This workshop introduces a conceptual framework and computational



<p>(250 words max.)</p>	<p>models to explore design spaces, understood as all the possible alternatives produced by combinations of input parameters. The main objective is modeling the complex decision-making process in multidimensional problems. To tackle this challenge, we will transit from generation of population of design alternative to the visualization and analysis of data of the performance results of each design option with respect to two typical conflicting objectives: Minimize energy consumption and maximize natural lighting</p>
<p>Handouts and Materials</p>	<p>TBC</p>
<p>Learning Objectives</p>	<ul style="list-style-type: none"> • Formulate multi-criteria design problems • Understand the fundamentals of parametric analysis • Represent priorities in a value function • Visualize data for qualitative analysis • Perform statistical sensitivity analysis to quantify the impact of individual input parameter on the overall results. • Model the decision-making process in multidimensional problems <p>Agenda:</p> <ul style="list-style-type: none"> • Design space construction of design alternatives • Sampling the design space • Implementation of analytical models • Parametric analysis of energy performance and daylight • Data visualization • Sensitivity analysis • Value function • Decision-making
<p>Sample Outcome</p>	<pre> graph TD Start((Start)) --> SetGoals[Set Goals] Start --> SetConstraints[Set Constraints] Start --> SetInputs[Set Inputs] SetGoals --> GenProp[Generate Proposed Design] SetConstraints --> GenProp SetInputs --> GenProp GenProp --> AnalyProp[Analyze Proposed Design] AnalyProp --> ConstSpace[Construct Design Space] ConstSpace --> SampleSpace[Sample Design Space] SampleSpace --> AnalyDoE[Analyze DoE Sample] AnalyDoE --> RunSens[Run Sensitivity Analysis] RunSens --> ValueAss[Value Assessment] ValueAss --> End((End)) </pre>
<p>Corresponding Conference Theme</p>	<p>(A) Human-computer computation. (B) Technology integration and collaboration</p>

3. Attendees Information

Who should attend this workshop?	Architecture and digital designers.
Prerequisites	<ul style="list-style-type: none">• Software: Previous install of Rhino, Grasshopper, JMP, Excel, EnergyPlus, Open Studio, Radiance, Daysim, Honeybee & Ladybug, TT_Toolbox, Lunchbox, Excel• Hardware: Personal Computer software compatible• Skills: Basic knowledge of Rhino y Grasshopper