Michael Carlos Barrios Kleiss, *PhD*

School of Architecture
College of Architecture, Arts and Humanities
Clemson University
Clemson SC 29634
crbh@clemson.edu | http://people.clemson.edu/~crbh

816 Lancer Circle
Ocoee, FL 34761
(617) 584-1804
cabeto@alum.mit.edu

EDUCATION

Doctor of Philosophy in Architecture: Design and Computation

Massachusetts Institute of Technology
Department of Architecture
Cambridge | Massachusetts | 2006

Major: Design and Computation
Minors: Computer Science, Artificial Intelligence, Computer Aided Manufacturing, Engineering
Thesis: "*Design Procedures: Computation and Parametric Design of Twisted Tall Buildings"*

ABSTRACT: Parametric modeling procedures applied to design and fabrication of complex shape architecture. A case study on twisted tall buildings is presented as the core example where the benefits of twisting towers are discussed. The thesis presents 5 types of parametric models to support all stages of the design process

Master of Architecture: Structural Morphology

Pratt Institute
School of Architecture.
Brooklyn | New York | 1999

Thesis: "***Transitions: A Morphological Analysis of the recent work of Renzo Piano***"

ABSTRACT: Euclidating Morphogenesis is used as a methodology to study and understand the governing principles of the structural language of Renzo Piano's design in the Jean Marie Tjibaou cultural center in New Caledonia. Piano's original designs are traced to a basic configuration of the simplest possible geometrical arrangement in a morphological step by step process. Each step is recorded as a metamorphosis transformation to uncover the fundamental morphological principles of the original structure. This knowledge is used to create new designs in the language

Diploma of Museum Design

Museum of Fine Arts
Caracas, Venezuela, 1995

Post-Graduate Museum Design

Special concentration in exhibits spaces, and museum planning and design

Diploma of Engineering

Universidad de los Andes
Merida, Venezuela, 1993

Post-Graduate Structural Engineering

Special concentration in structural engineering and seismic resistance structural design

Diploma of Architecture [B.Arch.]

Professional degree in Architecture
Universidad de los Andes
School of Architecture and Design
Mérida | Venezuela | 1993

Thesis: "***Design Patterns in Caribbean Vernacular Architecture***"

ABSTRACT: exploration of patterns in vernacular Caribbean architecture applied to sustainable design. The project included housing development, public spaces and a 24,000 M^2 market for hot and dry climate. Thesis included extensive use of passive solutions for sustainable climate control.

ACADEMIC POSITIONS

Director PhD Program: Planning, Design and the Built Environment
College of Architecture, Arts and Humanities
Clemson University
Clemson | South Carolina | 2021 - Present

Associate Professor of Architecture, Structures and Computation
School of Architecture
College of Architecture, Arts and Humanities
Clemson University
Clemson | South Carolina | 2016 - Present

Watt Innovation Center Faculty Fellow
Watt Family Innovation Center
Clemson University
Clemson | South Carolina | 2017- Present

Assistant Professor of Architecture, Structures and Computation
School of Architecture
College of Architecture, Arts and Humanities
Clemson University
Clemson | South Carolina | 2013 - 2016

Assistant Professor of Architecture
Architecture Program
School of Visual Arts and Design
College of Arts and Humanities
University of Central Florida
Orlando | Florida | 2011 - 2013

Chair of Research
School of Architecture and Planning
The Catholic University of America
Washington | District of Columbia | 2007-2011

Assistant Professor of Architecture and Structures
Master of Architecture & Master of Science in Sustainable Design Programs
School of Architecture and Planning
The Catholic University of America
Washington | District of Columbia | 2006 - 2011

Associate Professor of Architecture
Department of Architectural Composition
School of Architecture | Faculty of Architecture and Design
Universidad de los Andes
Mérida, Venezuela 1995-2007

GRADUATE THESIS ADVISING

Developing Design Guidelines of Deployable Bamboo Scissors-Like Arch Structures for Structural Performance, Flexibility and Constructability
Anastasia Maurina, Ph.D.
Planning and Design in the Built Environment
College of Architecture, Arts and Construction
Clemson University, August 2023
Co-Advisor

Reinforcement Learning Based Design Methodology for Building Performance: A case of building facades with kinetic elements
Sida Dai, Ph.D.
Planning and Design in the Built Environment
College of Architecture, Arts and Humanities
Clemson University, December 2021
Main Advisor, Chair of PhD Committee

A Method for 3D Printing a Concrete House
Chien-Ho Ko (PhD Candidate)
Planning and Design in the Built Environment
College of Architecture, Arts and Humanities
Clemson University
Main Advisor, Chair of PhD Committee

Culturally Specific Shape Grammars: Preservation of Geringsing Textile patterns through Computational Modeling and Etnography
Nyoman Dewi Pebryani, Ph.D.
Planning and Design in the Built Environment
College of Architecture, Arts and Humanities
Clemson University, May 2019
Main Advisor, Chair of PhD Committee

Computational Investigation of the Morphological Design Dimensions of Historic Hexagonal-Based Islamic Geometric Patterns
Mostafa Hashem Alani, Ph.D.
Doctor of Philosophy
Planning and Design in the Built Environment
College of Architecture, Arts and Humanities
Clemson University, August 2018
Main Advisor, Chair of PhD Committee

The Adaptable Growth of Sea Shells: Informing the Design of the Built Environment through Quantitative Biomimicry
Diana Cheng, Ph.D.
Doctor of Philosophy
Glen Department of Civil Engineering, Clemson University, 2016
Co-Advisor

Derivative, A formal exploration on dwelling typology
Terrance Perdue, M.Arch.
Master of Architecture Graduate Thesis, Ball State University, 2015
Member of Thesis Committee

Social Alchemy: A Weaving of Disciplines
Massey Brooks, Arch.D.
Doctor of Architecture

University of Hawaii, Manoa, 2015
Member of Dissertation Committee

Transportation, Media and Mass Communication
Elizabeth Turncliff, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2011
Principal Advisor and Chair of Thesis Committee

Connecting Places
Valerie Berstene, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2011
Principal Advisor and Chair of Thesis Committee

Hip-Hop Culture and Architecture
Michael Coyle, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2011
Advisor and Co-Chair of Thesis Committee

Bridging History: A reconstruction of an old railroad bridge
Val Hawkins, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2011
Committee Member / Reader

High Media: A high-rise development for future communications in Libya
Hussam Elkhrraz, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2011
Committee Member / Reader

Beyond the Wall: An intervention in Modern day Berlin wall
Lindsey Dehenzel, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2010
Advisor and Co-Chair of Thesis Committee

Archi-Biotics: Cybernetics, Technology and Design in the City
Audrae Lee, M.Arch
Master of Architecture Graduate Thesis, The Catholic University of America, 2010
Principal Advisor and Chair of Thesis Committee

Light and Shadow as a Space Maker
Christina Lemley, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2010
Principal Advisor and Chair of Thesis Committee

Parti and Core Mechanic: Game Design strategies for architectural design
Christian Totten, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2009
Principal Advisor and Chair of Thesis Committee

The Architecture of Taste: Designing a winery as a spatial experience
Christian Rose, M.Arch.
Master of Architecture Graduate Thesis, The Catholic University of America, 2010
Advisor and Co-Chair of Thesis Committee

Atonal Composition into Design
Damien Alomar, M.Arch.

Master of Architecture Graduate Thesis, The Catholic University of America, 2009
Principal Advisor and Chair of Thesis Committee

PROFESSIONAL EXPERIENCE

Planetary ONE, Brooklyn, NY (2010- 2017)

Design Partner

Design Partner In charge of design computing, structures and morphology.

Planetary ONE provides innovation through design knowledge networks that transform the speed, scope, and scale of a venture. We foresee strategies for people to shape their natural and cultural surrounds, re-think objects, transports, as well as the streets, parks, open spaces, cultural districts, civic centers, and business hubs that comprise the future metropolis. Ecological design is not only as a philosophy that inspires visions of sustainability but also a focused scientific endeavor

H. Thomas O'Hara Architect, New York, NY (1999-2001)

Project Architect, Project Coordinator
In charge of computing for digital modeling and rendering. Design development and construction documents for several high-rise residential buildings in New York City

Universidad de los Andes, Merida, Venezuela (1995-1999)

Architect, Physical Plant

Design architect and project coordinator for physical plant. Projects included the Cardiology Research Center, Law School academic and administrative buildings, Science Museum

CBSF Associates, Merida, Venezuela (1995-2006)

Principal
Private practice for residential and commercial buildings in Venezuela

Metro de Caracas C.A., Caracas, Venezuela (1991-1993)

Construction Supervisor
Assisted in daily duties for coordinated construction in first phase of line 3, consisting in 5 underground stations and 6 tunnels. Architect designer for surface reconstruction

RESEARCH GRANTS

GRANTS (after Tenue in Italics)

Precast Structural Morphology in Design Studio
PCI Foundation Research Grant ($75,000 Grant)
Pre-Cast & Pre-Stressed Concrete Institute Foundation, 2020 – Present

National Science Foundation Supplemental Award: Tessellated Structural Architectural Systems for Rapid Construction, Repair and Disassembly.
Principal Investigator. (Supplemental Grant $16,000.00) 2021

National Science Foundation Supplemental Award: Tessellated Structural Architectural Systems for Rapid Construction, Repair and Disassembly.
Principal Investigator. (Supplemental Grant $16,000.00) 2020

National Science Foundation Supplemental Award: Tessellated Structural Architectural Systems for Rapid Construction, Repair and Disassembly.
Principal Investigator. (Supplemental Grant $15,000.00) 2019

National Science Foundation: Tessellated Structural Architectural Systems for Rapid Construction, Repair and Disassembly. NSF award 1762899. August 2018. Principal Investigator. (Grant $259,905.00)

Faculty Research Development Program ($5,000)
College of Architecture Arts and Humanities
Clemson University, 2022

Faculty Research Development Collaborative Grant ($10,000)
College of Architecture Arts and Humanities
Clemson University, 2021

Morphology and Structural Performance
PCI Foundation Research Grant ($60,000 Grant)
Pre-Cast & Pre-Stressed Concrete Institute Foundation, 2018-2020

Creativity and Collaboration in Multi-Disciplinary Teams. The Watt Center for Innovation. Clemson University August 2018. Principal Investigator. (Collaborative Grant $50,000.00)

GRANTS before tenue

Clemson University Research Grant ($10,000)
Clemson University, 2016

Clemson Architectural Foundation Grant ($2,000)
Clemson University, 2015

Richard H. Pennell Center Grant ($15,000)
Clemson University, 2015

Faculty Research Development Program / Summer Research Grant ($3,000)
College of Architecture Arts and Humanities
Clemson University, 2015

Precast Performative Morphologies
PCI Foundation Research Grant ($100,000 Grant)
Pre-Cast & Pre-Stressed Concrete Institute Foundation, 2014

Faculty Research Development Program / Summer Research Grant ($3,000)
College of Architecture Arts and Humanities
Clemson University, 2014

Faculty Research Development Program ($3,000)
College of Architecture Arts and Humanities
Clemson University, 2014

Parametric Analysis in the Visual Arts Research Grant ($7,500)
Office of Research and Commercialization
University of Central Florida

Parametric Forms / Research Grant ($10,000)
School of Architecture and Planning
The Catholic University of America, January 2010

Fabricating Deployable Structures / Research Grant ($12,000)
Grant in Aid Program, Office of the Provost
The Catholic University of America, April 2008

Digital Architecture and Structures / Research Grant ($25,000)
Grant in Aid Program, Office of the Provost
The Catholic University of America, June 2007

AWARDS

Community Engagement Award
PCI Foundation, 2021

Distinguished Professor Award
Precast/Prestressed Concrete Institute, 2020

Watt Innovation Center Faculty Fellow
Clemson University, 2017

Thomas Upham Fellowship, MIT 2002-2006

Graduate Student Fellowship, MIT 2005

Special Graduate Students Award, MIT 2003-2004

Universidad de los Andes Faculty Fellowship, 1997-1999

Thesis: “Design Patterns in Caribbean Architecture for Sustainable Design”

PEER REVIEW PUBLICATIONS

BOOK CHAPTER

The Computation Nature of Gaudi’s Sagrada Familia in Computational Constructs: Architectural Design, Logic and Theory

Carlos Barrios, PhD
WACA, Shanghai, China, 2009

PAPERS (after Tenue in Italics)

Behavior and Modeling of Tessellated Shear Walls*. Syed, M., Okumus, P., Elhami Khorasani, N., Ross, B. E., Kleiss, M. C. B. Resilient Cities and Structures,* Special Issue on Resilience of Structures to Earthquakes*,* Editors: *Henry, R., Kurama, Y., 2(1), 152-161. (2023)*

Dynamic Environmental Plugins: Programmable Artifacts Reactive to Socio-Environmental Conditions” *24th International Conference on Human-Computer Interaction. Alani M., Kleiss M., Alwan, M, and Dai, S.*

Undergraduate Student Experience in a Multidisciplinary Architecture-Civil Engineering Research Project*. Crocker, Grace F., Bender, Katie, Blasiak, Riley, Lang, James, Moore, Seth, Wright, Olivia, Dai, Sida, Syed, Mohammad, Elhami-Khorasani, Negar, Kleiss, Michael Carlos, Okumus, Pinar,*

and Ross, Brandon E. Proceedings of American Society for Engineering Education 2022 Annual Conference, Charleston, SC

***Failure Modes of 3D-Printed Tessellated-Tile Beams**. Crocker, Grace F., Dai, Sida, Ross, Brandon E., Kleiss, Michael Carlos, Okumus, Pinar, Elhami-Khorasani, Negar, and Moore, Seth. Proceedings of Structures Congress 2022, Atlanta, GA.*

***Tested Shear Capacity of a Tessellated Precast Concrete Specimen**. Bender, Katie E., Crocker, Grace F., Ross, Brandon E., Kleiss, Michael Carlos, Okumus, Pinar, Elhami-Khorasani, Negar. The 2022 PCI Convention*

***Reinforcement Learning-Based Generative Design Methodology for Kinetic Façade**. Sida Dai, Michael Kleiss, Mostafa Alani, Nyoman Dewi Pebryani. Association for Computer-Aided Architectural Design Research in Asia Conference (CAADRIA). 2022*

***Finite Element Modeling of Tessellated Beams.** Elsayed, Mohamed Ezz Abdelmoneim, Crocker, Grace F., Ross, Brandon E., Okumus, Pinar, Kleiss, Michael Carlos, and Elhami-Khorasani, Negar Journal of Building Engineering, 46, 2022.*

***Analytical Study of Tessellated Structural-Architectural Reinforced Concrete Shear Walls**. Syed, M., Moeini, M. , Okumus, P., Elhami Khorasani, N., Ross, B. E., Kleiss, M.C. (2021). Engineering Structures, 244, 112768*

***Responsive Origami: A Modular Approach to Fabricate Dynamic Surfaces Reactive to Socio-Environmental Conditions**. 22nd International Conference on Human-Computer Interaction (proceedings published in Lecture Notes in Computer Science, Scopus Cite Score 1.9). Mostafa Alani, Michael C. Kleiss, Arash Soleimani.*

***Design, Fabrication, and Assembly of a Tessellated Precast Concrete Wall**. Crocker, Grace F., Ross, Brandon E., Kleiss, Michael Carlos, Okumus, Pinar, Elhami-Khorasani, Negar, and Romano, John Michael. Proceedings of the 2021 PCI Convention, New Orleans, LA. Precast Concrete Institute.*

***Shape Grammars in Computational Generative Design for Origami**. Sida Dai and Michael Kleiss. Association for Computer-Aided Architectural Design Research in Asia Conference (CAADRIA). 2020*

***Tessellated Structural-Architectural Systems: A Concept for Efficient Construction, Repair, and Disassembly**. Ross, B, Yang, C. , Kleiss, M.C., Okumus, P., Elhami Khorasani, N. (2020) ASCE Journal of Architectural Engineering, 26(3),*

***Preliminary Testing of Tessellated Beam Structures**. Dodd, Sam, Ross, Brandon E., Crocker, Grace F., Kleiss, Michael Carlos, ELhami-Khorasani, Negar, Okumus, Pinar, and Dai, Sida. 9th International Conference of Mechanics and Materials in Design.*

Experimental Test of a Precast Reinforced Concrete Tessellated Shear Wall. *Crocker, Grace F., Ross, Brandon E., Kleiss, Michael Carlos, Okumus, Pinar, and Elhami-Khorasani, Negar.*

A Parametric Description for Metamorphosis of Islamic Geometric Patterns*. Emerging Experience in Past, Present, and Future of Digital Architecture: The Association for Computer-Aided Architectural Design Research in Asia (CAADRIA) conference. Mostafa Alani, Michael Carlos Barrios Kleiss.*

Chronological Examination of the Morphology of Hexagonal Based Islamic Geometric Patterns*. Virtual + Actual: Process and Product of Design. Design Communication Association 2018. Mostafa Alani, Michael Kleiss and Joseph Choma*

From Known to New: Morphological Analysis as an Academic Approach for Structural Innovation*. 6th Structural Engineering World Congress. Cancun, Mexico, November 2017. Kleiss, Michael; Ross, Brandon; Alani, Mostafa.*

Parametric analysis in Islamic geometric designs*. The next city - New technologies and the future of the built environment. 16th International Conference CAAD Futures 2015. Carlos Barrios Kleiss. Mostafa Alani.*

A Parametric Metamorphosis of Islamic Geometric Patterns. *Future of Architectural Research: Architectural Research Centers Consortium (ARCC) conference. Mostafa Alani, Carlos Barrios.*

Tessellated Structural Patterns
Ross, B., Kleiss, M., Okumus, P., Korassani, N.
Journal of Engineering and Architecture. 2020

Ethno-Computation: Culturally Specific Design Application of Geringsing Textile Patterns
Nyoman Dewi Pebryani & Michael Kleiss
Computer Aided Architectural Design Futures (CAAD Futures) Daejoon, South Korea, June 2019.

Induced Group and Symmetry Group Theory: Generating New Designs from Known
Nyoman Dewi Pebryani & Michael Kleiss
Computer Aided Architectural Design Research in Asia (CAADRIA) Beijing, China, May 2018

Design Method in Tracing Known Design: Keketusan Balinese Ornamentation
Nyoman Dewi Pebryani & Michael Kleiss
Computer Aided Architectural Design Research in Asia (CAADRIA) Suzhou, China, May 2017

PAPERS (before Tenue)

Parametric Transformations in Islamic Geometric Patterns

Carlos Barrios Kleiss, *PhD* & Mostafa Hashem
Computer Aided Architectural Design Futures (CAAD Futures)
Sao Paulo, Brazil, July 2015

Metamorphosis in Islamic Geometric Patterns

Carlos Barrios, *PhD* & Mostafa Hashem
Computer Aided Architectural Design Research in Asia (CAADRIA)
Taegu, South Korea, May 2015

The Extraction of New from Traditional

Mostafa Hashem & Carlos Barrios, *PhD*
Architecture Research Centers Consortium (ARCC)
Chicago, Illinois, February 2015

Periodic Arrangements of Parametric Gaudinian Columns in Hypercubes (poster & presentation)

Carlos Barrios, *PhD*
Design Computing and Cognition (DCC 2014)
London UK, June 2014

Intra-Disciplinary Pedagogy in Design

Carlos Barrios, PhD, Ufuk Ersoy, PhD. Daniel Harding, Dustin Albright
Association of Collegiate Schools of Architecture International Meeting
Seoul South Korea, June 2014

Navigation and Visualization in Multidimensional Spaces

Carlos Barrios, *PhD*
Computer Aided Architectural Design and Research in Asia (CADDRIA)
Kyoto Japan, May 2014

Parametric Models in Hyperspace

Carlos Barrios, *PhD*
102nd ACSA annual meeting. Association of Collegiate Schools of Architecture
Miami Florida, April 2014

A Textile Block Grammar: Shape Grammars in Frank Lloyd Wright's Californian Textile Block houses

Carlos Barrios, *PhD*
Congreso Internacional de la Sociedad Iberoamericana de Grafica Digital, SIGraDi,
Valparaiso, Chile, November 2013

Parametric Affordances: What? When? How?

Carlos Barrios, *PhD*
Association for Computer Aided Design in America Regional Conference (ACADIA)

Lincoln, Nebraska, March 2011

Computing with Textile Blocks

Carlos Barrios, *PhD* and Damien Alomar
Computer Aided Architectural Design and Research in Asia (CADDRIA)
Chiang Mai, Thailand, April 2008

Process as the Link Between Design and Making

Carlos Barrios, *PhD* and Damien Alomar.
96th ACSA annual meeting. Association of Collegiate Schools of Architecture
Houston Texas, March 2008

Cognitive Models for Parametric Design

Carlos Barrios, *PhD*
XI Congreso Internacional de la Sociedad Iberoamericana de Grafica Digital, SIGraDi,
Universidad La Salle, Mexico, October 2007

Expanding Design Boundaries: *Symmetry Experiments in Frank Lloyd Wright's Textile Block Houses*

Carlos Barrios, *PhD*
Education and research in Computer Aided Architectural Design in Europe, eCAADe,
Technical University of Frankfurt am Main, Frankfurt, Germany, September 2007

Thinking Parametric Design: Introducing Parametric Gaudi

Carlos Barrios, *PhD*
Design Studies 27 (2006) pp 309-324
Especial issue on Digital Design and Architecture. Editor: Rivka Oxman.
Elsevier, UK

Evaluation of Parametric Models: *Two provisos for evaluating the column designs of the Expiatory Temple of the Sagrada Familia*

Carlos Barrios, *PhD*

IX international congress of the Interamerican Society of Digital Graphics, SIGraDi,
Universidad Peruana de las Ciencias Aplicadas (UPAC), Lima, Peru, November 2005

Symmetry, Rules and Recursion: *How to design like Santiago Calatrava.*

Carlos Barrios, *PhD*
Education and research in Computer Aided Architectural Design in Europe, eCAADe
Technical University of Lisbon (TU Lisbon), Lisbon, Portugal, September 2005

Counting Parametric Models

Carlos Barrios, *PhD*
CAAD Futures 2005, Technical University of Vienna (TU Wien)
Vienna, Austria, June 2005

Parametric Gaudi

Carlos Barrios, *PhD*
VIII International congress of the Interamerican Society of Digital Graphics, SIGraDi
Universidad do Rio Grande do Sul (UNISINOS), Sao Leopoldo, Brazil, November 2004

INVITED PRESENTATIONS

Parametrics in Gaudi's Designs (Invited Lecture)

Michael Carlos Barrios Kleiss, PhD
School of Architecture
Tuskegee University (2017)

Design Topology (Key Note)

Carlos Barrios, PhD
Trans-Element Symposium Washington DC 2012

Design Morphology

Synthetic Reality Lab (SREAL)
Institute for Simulation and Training (IST)
University of Central Florida

Parametric Affordances: What? When? How?

Carlos Barrios, PhD
Association for Computer Aided Design in America Regional Conference (ACADIA)
Lincoln, Nebraska, March 2011

Recent work on Parametric Design

MIT 2nd Design and Computation Symposium
Cambridge, MA, February 2010

Design is Parametric

MIT 1st Design and Computation Symposium
Cambridge, MA, February 2009

Thinking Parametric Design

American Institute of Architects in New York
New York, NY, November 2008

Parametric Modeling & Parametric Design (invited)

Summer Institute of Architecture
School of Architecture and Planning. The Catholic University of America
Washington DC, June 2008

Structural Poetry (invited)

Comprehensive Building Design Studio
School of Architecture and Planning. The Catholic University of America
Washington DC, January 2008

Gothic Rebuilt

Summer Institute of Architecture
School of Architecture and Planning. The Catholic University of America
Washington DC, June 2007

On Structural Systems and Structural Design (invited)

Comprehensive Building Design Studio
School of Architecture and Planning. The Catholic University of America
Washington DC, February 2007

What is Design Computing?

Summer Institute of Architecture
School of Architecture and Planning. The Catholic University of America
Washington DC, July 2006

Design Procedures

Design Computation Lecture series
Department of Architecture. Massachusetts Institute of Technology
Cambridge, MA, April 2006

Computational Design Solutions (series)

Department of Architecture
Massachusetts Institute of Technology
Cambridge, MA, January 2006

Digital Design Fabrication (invited)

Universidad do Campinas UNICAMP, Campinas, Brazil, November 2004

Parametric Smart Geometry

Cambridge University, Cambridge UK, June 2003

Computers and Designers in Computer Aided Design (invited)

Universidad de los Andes, Merida, Venezuela, June 2002

Transitions, A morphological analysis on the recent work of Renzo Piano

Universidad de los Andes, Merida, Venezuela, July 2001

EXHIBITIONS OF ARTISTIC WORK

UCF School of Visual Arts Faculty Show

School of Visual Arts and Design Art Gallery
University of Central Florida
October – November 2012

UCF School of Visual Arts Faculty Show

School of Visual Arts and Design Art Gallery
University of Central Florida October – November 2011

Parametric Sculptures

Recent developments in parametric forms
Inter-American Development Bank Cultural Center
Washington DC May – June 2011

Parametric Winter

Parametric Models of complex shapes on Octahedral symmetry group
Project 4 Gallery
Washington DC April – July 2010

Vertigo

Parametric models of complex forms in the rod symmetry group
Project 4 Gallery
Washington DC September – November 2009

Atonal Musical Composition as a Form Generator
In collaboration with Damien Alomar
Wolk Gallery
Cambridge MA September – December 2008

Digital Design at SIGGRAPH

Computer generated models based on Gaudi's rules for the columns of the Sagrada Familia
Los Angeles Convention Center
Los Angeles CA August 2008

Super Towers

Exhibit of research and student work on complex forms for super tall buildings
Summer Institute of Architecture
Washington DC June – August 2007

Parametrics on Gaudi's Sagrada Familia

Parametric Models of the columns of the Sagrada Familia
The Catholic University of America
October – December 2006

SELECTED RESEARCH

Tessellated Structural Architectural Systems TeSA (2017-present)

This research project investigates the use of interlocking systems for architectural and structural applications for increased building performance, resilience and aesthetics.

Parametric Analysis in the Visual Arts (2012-2013)

This research project aims investigate the use of parametric models for applications in the visual arts. This project is funded by a grant from the Office of Research and Commercialization of the University of Central Florida.

Virtual Orlando (2011-2013) Collaboration with Dr. K. Thomas McPeek, PhD

This research project aims to produce a database of information on selected historical buildings in the city of Orlando. This project is carried in collaboration with the City of Orlando and the Synthetic Reality research group (SREAL) at the Institute of Simulation and Training (IST)

Parametric Arrangements on Hyper-Structures (2010 - Present)

This research project aims to produce a multi-dimensional matrix of all possible designs produced from a parametric model in Cartesian systems higher than three dimensions. A complete set of the columns of the Sagrada Familia was completed as a prototype of the system in a tessellated Tesseract, a hypercube of 4D. Current work is looking at combining parametric shape grammars with arrangements in 5D and 6D hypercube lattices.

Design Morphology of Kinetic Structures (2000 - Present)

Non-standard deployable structures are generated from a novel methodology applied to angulated scissors mechanism. The methodology allows the creation of regular and irregular deployable frames with designs allowance for complete closed packing and fast deployment.

Textile Parametrics (2002 - Present)

This project looks on the legacy of Frank Lloyd Wright's textile block houses and applies to contemporary digital fabrication processes. The research takes the principle of the single block unit with embedded parametric variables for local adaptability and mass customization. Initial results have identified all the symmetry groups belonging to the textile block designs, and completed a catalog of all possible designs using the original Frank Lloyd Wright rules. A Visual Basic computer application was written to generate the original textile blocks and new designs in the language

Outside the Box: Complex Geometry in Skyscrapers (2004 - Present)

This ongoing research explores new developments in the formalistic and structural forms for high-rise buildings. It also explores how computational and digital fabrication technologies continue to challenge the steel and glass extruded box paradigm of modern skyscrapers and other historical types. This research also explores the ecological benefits of complex forms in high-rise buildings

Symmetry Descriptions for Non-Regular Shapes (ongoing)

This current research project explores a series of experiments in looking for a unified theory to provide accurate symmetry descriptions of non-regular 3D shapes. Symmetry groups are the product of operations that identify regular patterns in shapes. This research aims to present a unified class for the description of complex shapes. This project has resulted in two exhibits and was funded by the Catholic University of America Grant in Aid program

Gothic Rebuilt (2006 - Present)

This pilot project focused on digital reconstruction of medieval cathedrals and production of 3D models in rapid prototyping devices. The goal is to have a live

archive of historical buildings to be used for research and teaching aids. In particular the research aims to take a closer look to the advances of structural systems in medieval structures. Specific attention is given to the development of the structural components that resulted in higher and lighter buildings. This pilot project was funded by the Grant in Aid program

Parametric Gaudi (2002 - Present)

This research established a methodology for digital geometric modeling of complex forms: *Design Procedures*. Successfully completed parametric models of the columns of the Sagrada Familia temple demonstrating the usefulness of parametric models in design. Generated more than 400 new column designs in less than 4 days. Using a 3D printing device fabricated 92 rapid prototype models of the column designs in less than 2 weeks. This work done with the assistance of Professor Mark Burry from the Royal Melbourne Institute of Technology in Australia. Parametric models for the vaults are currently being developed.

Thin-Shell Structure Grammars (2004 - Present)

Designed and wrote a computer application in AutoLISP that generates frame structures from ruling lines of curved surfaces. The application successfully created systematic compositions and random arrangements of tessellated triangular shapes. The program generated STL output files for 3D printing devices in seconds. Generated a total of 86 designs form the parametric models and completed 32 rapid prototypes in ZCorp printing machine in a matter of days

Digital Design Fabrication (2002 - 2006)

In collaboration with Professor Larry Sass, MIT

Develop and completed a set of seven exercises for teaching digital fabrication and rapid prototyping in graduate level courses at MIT's Department of Architecture. The exercises have been successfully used in undergraduate and graduate courses pertaining digital design, rapid prototyping and digital driven fabrication. One of the courses is now a required class in the computation stream for both undergraduate and graduate programs at MIT

Fabricating Surfaces (2002 - 2004)

In collaboration with Professor Larry Sass, MIT

Designed a double curved glass curtain wall system and joint details. Build parametric computational models for rapid prototyping in Fuse Depositional Model machines (FDM) of the curved glass molds and join fittings. Constructed more than 22 models at different scales using a variety of rapid prototyping devices to test the components of the curtain wall system. Build quarter size mockup of the curved wall with all assembly components.

Shape Grammar on Santiago Calatrava (2000 - 2004)

In collaboration with Professor Terry Knight, MIT

Developed a shape grammar of the work of Spanish Architect Santiago Calatrava. The shape grammar reconstructed 32 of the most significant buildings designed by the architect before 2001, and generated more than 900 new possible designs in the language

Morphogenesis on Renzo Piano (1998 - 2000)

Work on morphological analysis of the structures of Renzo Piano. Made scale and computer models and analyzed selected Piano's designs. Project done under the supervision of Professor Haresh Lalvani, Pratt Institute

SELECTED TEACHING

Fluid Studio / Synthesis Studio (Clemson)*, Clemson University*

ARCH 3510 Design studio for increasingly comprehensive design projects, with varied scales and programs, with an emphasis on pre-design, site design, sustainability, and collaborative processes. Emphasizes the relationship between architecture, site and context. Studio may be located in Clemson, Charleston, Barcelona or Genoa.

ARCH 4520 Integrates acquired skills, abilities, and interests from previous architecture studios. Projects emphasize the accumulation of architectural experiences and knowledge.

Building Processes and Technical Resolution *Clemson University*

ARCH 8470 Develops the designer's ability to assess, select and conceptually integrate structural systems, building envelope systems, environmental systems, life-safety systems and building service systems in a sustainable building design.

Design Science *Clemson University (NEW COURSE)*

ARCH 8790 Critical consideration of special topics in architectural technology from which students construct their own informed and reasoned ideas about what the topic means for their own developing architectural practices. May be repeated for a maximum of six credits

Graduate Design Studio III*, Clemson University*

ARCH 8510 addresses architectural problems with varied scales, programs and locations. Emphasizes the relationship between architecture and context. Projects involve collaboration in the studio and with other disciplines to result in architectural solutions for the built environment

Structures II *Clemson University*

ARCH 2710 The study of force distributions and behavior in building structures constructed of reinforced concrete, steel and wood. Exploration of typical building components including beams, slabs, columns and foundations and how they are used in high-rise and long span structural design

Structures I *Clemson University*

ARCH 8700 Forces and their applications to statically determinate structural components and systems. Shear, moment and other stress-strain patterns are explored in multiple structural materials

Materials and Methods of Construction, *University of Central Florida*

Methods of assembling and selecting materials; detailed systems of construction are investigated. The course will concentrate on recent developments in fabrication technologies applied to the design and construction of complex geometry in architecture. Course topics include digital design, construction automation, building information modeling, digital mockups, digital fabrication, rapid prototyping, computer aided manufacturing, integrated product delivery, and design collaboration

Environmental Technology, *University of Central Florida*

Principles and practices relating to control of the thermal/atmospheric environment and plumbing in buildings. Environmental Technology 1 will focus on application of **Intelligent Kinetic Systems** and **Smart Responsive Environments**. The course will concentrate on recent development in ecology, design and digital fabrication developed in the early 21st century. Course topics include kinetic systems, digital design, responsive environments, and movable and deployable structures

Design Studio 8, *University of Central Florida*

Advanced design studio in UCF architecture program. This course focuses in morphology research and various aspects of digital design and digital media. Students are exposed to a variety of software for computational design

Design Studio 7, *University of Central Florida*

Advanced design studio in UCF architecture program. This course focuses in buildings in the city and presents various aspects of multi-story mixed-use building design. Students are exposed to a variety of case studies and precedents

Architectural Structures, *University of Central Florida*

Architectural Structures introduces basic concepts of structural mechanics applied to building structures. Through lectures and projects students are exposed to principles of structural design.

Parametric Modeling and Design, *(NEW COURSE) University of Central Florida*

Parametric modeling and Design is a new course offered as an elective for the architecture program in the School of Visual Arts and Design.

Shape Grammars, *(NEW COURSE) University of Central Florida*

This new course is proposed as an undergraduate upper-class elective in the School of Visual Arts and Design. Shape grammars looks at systematic approaches to creativity in design

Digital Media Advanced Graduate Studio, *The Catholic University of America*

Advanced design studio in the Digital Media graduate concentration. This course focuses in various aspects of digital design and digital media. Students are exposed to a variety of software for modeling, animation, visualization, video editing, and photorealistic rendering

Digital Fabrication Graduate Studio, *The Catholic University of America*

Advanced studio in the Design Technologies concentration. Students focus their attention on computational techniques and digital fabrication. This studio concentrates on the method of Euclidating Morphogenesis to analyze existing structures and generate the new designs.

Comprehensive Building Design Studio, *The Catholic University of America*

Capstone studio in the undergraduate program. This studio builds upon a broad base of design skills to explore in greater depth practical issues of architecture as a profession. Students work in teams to develop a mid-scale project to the level of Design Development and Construction Documents. A complete set of professional drawings and documents is expected

Design Morphology, *The Catholic University of America.*

This course explores the principles of morphogenetic design based on Euclidating Morphogenesis analysis of existing patterns from nature and built works. Past courses have explored the study of helicoidally formed structures in sea-shells, mollusks, and plants. The workshop explores the fundamental principles geometry, topology, symmetry, periodic arrangements and ruled based design, and studies their application to controlled experiments. Parametric driven modeling software and rapid prototyping machines are used for supplement

Structures I, *The Catholic University of America*

Structures I introduce basic concepts of structural mechanics applied to building structures. Through lectures and projects students are exposed to principles of structural design. Topics include structural analysis of beams, trusses and cables, load tracing, and lintels

Structures II, *The Catholic University of America*

Structures II focuses on strength of materials and mechanical properties of form. Topics include stress, and strain, moment and shear diagrams, moment of inertia, and load factors applied to steel and concrete structures. Analysis of beams and columns is presented

Advanced Structures, *The Catholic University of America*

Advanced Structures focuses on analysis and design of steel and concrete structures with an emphasis on frames. Additional topics include cables, continuous beam, indeterminate structures, lateral loading and seismic resistance.

Shape Grammars, *The Catholic University of America.*

This subject introduces a computational generative approach to design using shape grammars. Shape grammars are a formalism that provides powerful means for design analysis and synthesis, design exploration, generative design, and design languages. The class covers topics such as shape and shape-rules, symmetry, spatial relations, design derivations, and design evaluation. Case studies are presented to understand the application of shape grammars in design research, design analysis and their use in creative design.

Rapid Prototyping, *The Catholic University of America*

This course introduces students to principles and techniques for computer controlled fabrication. Topics include learning tools and software for desktop manufacturing, rapid prototyping and computer numerical control fabrication. Students are exposed to a variety of rapid prototyping devices through a series of weekly exercises, accompanied by selected readings.

Architectural Design Studio III, *Summer Institute of Architecture*

This core studio builds upon the conceptual foundations and tectonic knowledge to do projects of increasing scale and programmatic complexity. It promotes the student's ability to develop design solutions for human environments through a process of observation, analysis and synthesis. Emphasis is on the integration of different scale projects in the city. This could be from furniture to architecture or from urban design to building components. This studio focused on high-rise design

Digital Mockups: Digital Design of Super Tall Building

Co-instructor, MIT, Spring 2005
In collaboration with Foster and Partners, Arup R&D, SOM and KPF. London and New York City

This workshop explored digital design and fabrication systems for complex shapes and how they are applied to high-rise architecture. Parametric modeling software and rapid prototyping machines where used for exploration and development of building information models applied to the design of tall buildings. The workshop included field trips to London and New York

Design Fabrication Workshop: Design Fabrication with Frank Gehry

Teaching Assistant, MIT Spring 2004

Design workshop conducted in collaboration with the office of Gehry and Partners and Gehry Technologies. The class studied design solutions with fabric as a building material, parametric modeling, rapid prototyping and digital fabrication

Digital Design Fabrication

Teaching Assistant, MIT, Fall 2003/Fall 2004

Design Fabrication is an introductory course in advanced computing, rapid prototyping and building fabrication focused on the relationship between design, generative computer modeling and physical representation using digital fabrication devices. Computers and small rapid prototyping devices are used to simulate real world CAD/CAM processes. Tools and techniques taken from current research and practices using rapid prototyping are applied to the new design office, focused on how software and machines impact the design language and design practice

Parametric Tools for Design Development and Digital Fabrication

Workshop with Foster and Partners, London. Research Assistant Spring 2003

Supported the class with Catia software and Visual Basic scripting in Rhino. Design workshop done in remote collaboration with the *Specialist Modeling Group* of the firm of Foster *and Partners*. The workshop explored computational tools for generative designs, parametric modeling systems and digital design fabrication with rapid prototyping devices.

Introduction to Parametric Design

Instructor, January 2003

Developed tutorials for learning parametric design in Catia. Taught Parametric modeling in CATIA Version 5 Release 9 for a group of 20 students of the Department of Architecture and the Department of Civil and Environmental Engineering at MIT

Fabricating Ceramics

Workshop in collaboration with the TU Lisbon. Teaching Assistant, Fall 2002

Developed tutorials for learning parametric modeling. Supported the class with rapid prototyping devices and video conference. This workshop explored methods for fabrication of ceramic fabrication. It was done in collaboration with the Technical University of Lisbon

LEADERSHIP SERVICE

Clemson University

Search Committee for Dean of College of Architecture, Arts and Humanities (CAAH)

Chair of Search Committee for College of Architecture, Arts and Humanities (CAAH) Associate Dean of Graduate Studies and Research

Faculty Advisory Committee, College of Architecture, Arts and Humanities (CAAH)

Member Academic Technology Council (University committee)

Faculty Search Committee (School committee)

Scientific Committee of Journal Research in Architecture and Urbanism, Brazil (international committee)

Reviewer for Design Studies Journal (International committee)

Reviewer for American Society for Digital Graphics SIGraDi (international committee)

Reviewer for Association of Computer Aided Design in America ACADIA (international committee)

Precast/Prestressed Concrete Institute

Member of Research and Development Council

Member of Structural Innovation committee

Member of Publications committee

Council on Tall Buildings and Urban Habitat (CTBUH)

Member of Education committee

Member of Research committee

University of Central Florida

ACSA Faculty Councilor

Member of Faculty Search Committee
Member of Research Committee
Member of Curriculum Committee

Catholic University of America
Chair of Research
Chair of the Exhibits Committee
Member Curriculum Committee
Member Thesis Committee
Member Sustainable Committee
Member Technology Committee
ACSA Faculty Councilor

Massachusetts Institute of Technology
Vice-President of the Architectural Student Council (elected officer)
PhD Representative to the Architectural Student Council (elected officer)
Design and Computation Student - Faculty liaison
PhD Design and Computation admissions committee

Universidad de los Andes
Faculty Council Member, elected officer
Department Council Member, elected officer

PROFESSIONAL REGISTRATION

Registered Engineer Venezuelan Board of Engineers CIV 87467
Registered Architect Venezuelan Board of Architects CAV 5045

COMPETENCIES

COMPUTATIONAL DESIGN
Shape Grammars, Processing, Java, AutoLISP, Visual Basic, MEL, MAX Script, Rhino Script, VBA

PRODUCT LIFECYCLE MANAGEMENT & ENGINNERING
CATIA, Unigraphics, ProEngineer, SolidWorks, Digital Project, Master CAM, Multiframe, SAP2000, EcoTech

GEOMETRIC MODELING & BIM
Softimage, Alias, 3DStudioMAX, AutoCAD, Mechanical Desktop, MAYA, Rhino 3D, FormZ, Revit, Generative Components, Grasshopper

DIGITAL MEDIA
Photoshop, Premier, After Effects, Illustrator, Final Cut, Flash, Prezi

LANGUAGES

Fluent in Spanish and English. Conversant in French, basic Italian

SPECIAL INTERESTS

FLIGHT
Paraglider instructor. Hanglider and Sailplane pilot. Single engine pilot in training.

SCUBA DIVING
Open Water Instructor, Advanced Open Water Instructor, Technical Diver Instructor, Extended Range, Deep Diving, Wreck Diving Instructor, Advanced cave diver.

OUTDOORS
Mountain climbing, scuba diving, rafting, sailing.

MARTIAL ARTS
Aikido, Karate Do Shoto Kan, Tae Kwon Do, Ninjutsu

HOBBIES
Photography, astronomy, astrophysics, film, production design, gourmet cooking