2017-2018 Creative Achievement

Shahin Vassigh
32527

2017

TEACHING AND RESEARCH PORTFOLIO

SHAHIN VASSIGH

Florida International University
School of Architecture

TABLE OF CONTENTS

Candidate's Statement

Funded Projects

A comprehensive Approach to Teaching Structures
U.S. Department of Education, Fund for the Improvement of Postsecondary Education, 2001-2004

Interactive Structures: Visualizing Structural Behavior

Building Literacy: The Integration of Building Technology and Design in Architectural Education
U.S. Department of Education, Fund for the Improvement of Postsecondary Education, 2007-2011

Building Systems Integration for Enhanced Environmental Performance
Best Practices in Sustainable Building Design
Best Practices in Sustainable Building Design Learning Software
Building Simulator

Strategies for Learning: Augmented Reality and Collaborative Problem-Solving for Building Sciences
National Science Foundation: Improving Undergraduate STEM Education, 2015-2018

Augmented Reality and Virtual Reality Leaning Tools (AR and VR Skope)

Labs

Structural and Environmental Technology laboratory (SET Lab)
Florida International University, 2008-Present

Integrated Computer Assisted Virtual Environment (I-CAVE)
Florida International University, 2015- Present

Robotics and Digital Manufacturing Laboratory (RDF Lab)
Florida International University, 2016- Present

Courses

Structures I- Introduction to Structures
Structures II- Wood and Steel desgin
Structures III -Concrete Design
Kinetic Structures
Tall Building Design Studio

CANDIDATE'S STATEMENT

Early in my career it became clear to me that the traditional approach to teaching technology and structural science to architecture students faced two fundamental issues: first, my students consistently struggled with structures courses, to the point that many would openly complain that the technology component of their education is irrelevant, incomplete, and incomprehensible. Second, my students left the University unprepared to communicate and collaborate with other professionals.

For decades, structures courses were taught using methods, materials, and teaching styles that used either overly quantitative engineering methods (relying exclusively on complex mathematical formulae), or were taught with oversimplified qualitative approaches leaving critical structural analysis out of the curriculum. It turned out that this experience was not only common for architecture students, but also a common frustration for most faculty teaching the subject. The lack of technical preparation among architecture graduates has since been recognized as a major problem facing the practice of architecture. Solving this problem – how to deliver the complex subjects of building technology and structures to architecture students in a way that matches their skills, capacity and learning styles has driven my teaching and research for the past two decades. In doing so, I have tried strike a balance by connecting theory to practice (design) in innovative ways. It has been my hope to improve students' learning experience and have them better prepared for the increasingly technical and collaborative practice of architecture.

My teaching and research are closely intertwined, focusing on the development of advanced teaching tools making use of, simulation modeling, advanced visualization, and most recently, virtual reality and augmented reality technologies that blend physical and digital learning environments. I have built a nationally recognized body of research work and publications characterized as setting new standards for new media educational materials, supported by over $1,600,000 in sponsored research funding. Most importantly, my work has produced innovative interactive learning tools and textbooks with a clear distinctive visual approach to teaching technology. My teaching tool products have been extensively tested and are now used across the US and abroad.

In Visualizing Structural Behavior: An Interactive Approach to Teaching Structures using Advance Media, I took a particular approach to teaching structures by providing contextual information and virtual case studies with a high level of interactivity. In this tool, I used a wide range of visualization techniques including dynamic modeling to show structural behavior that cannot be observed otherwise, layering and fading information as needed to support on-demand learning, audio narration, and interactive examples of Architects' work. This project took over 4 years to complete and received the Annual American Institute of Architects (AIA) University Research Award. My other software, Best Practices in Sustainable Design, is a digital learning environment for climate responsive and ecologically sustainable building design. Harnessing the capabilities of advanced media, such as animations, interactive diagrams and hypertext, the software-generated environment helps students to visualize and engage concepts that are difficult to grasp in traditional learning formats.

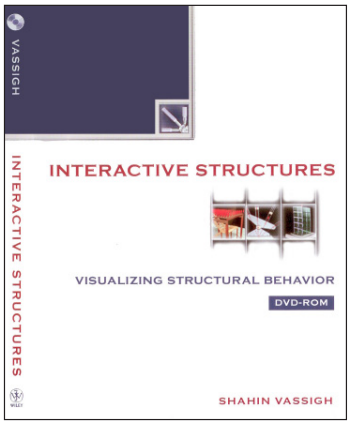
My most recent project supported by the National Science Foundation integrates Augmented Reality (AR) with Building Information Modeling (BIM), gaming engines, visual simulations, and interactive lessons to a create tool for students to better understand the complex building systems. Like having an interactive x-ray vision, students can use the tool to move around a building to view through its material and composition such as façade systems, structural systems, mechanical systems, plumbing, etc., and receive information on site.

Establishing the Structural and Environmental Technologies Lab (SET) at the School of Architecture, has been a transforming force in my teaching ability. I led the effort collaborating with a colleague to secure equipment funding and an extension to our existing Architecture building for creating the SET lab. The pedagogical approach of the lab builds on new educational theories that consider learning as an active and constructive process that is inherently social. Using various experiments, the lab supports student interaction working on a common problem with a hands-on approach using both low-tech and high-tech equipment. Currently I am working on that last stages of establishing a new Robotics lab with the state of the arts equipment to further enhance technology teaching at our institution.

Lastly, my collaborative inter-institutional funded projects have given me the opportunity of steadily supporting many students with funding, teaching, training and mentorship throughout the years. These projects have continuously provided networks of faculty and students who work together to improve architectural education. My student assistants have contributed to software development, books and publications, and have presented at conferences. All student assistants have received full recognition and credit for their work in multiple venues.

Shahin Vassigh, Professor of Architecture
Associate Dean of Reserach and Faculty Development

College of Communication, Architecture + The Arts
Florida International University
11200 SW 8 St.
Miami, FL, 33199

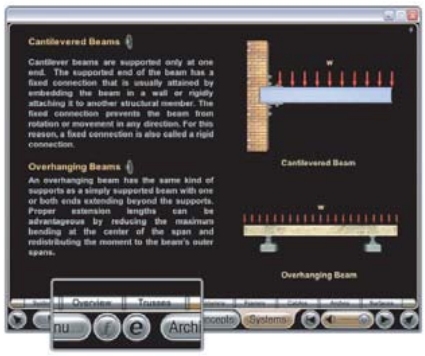


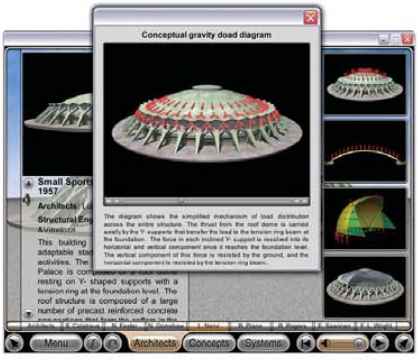
Project Title: A Comprehensive Approach to Teaching Structures, Comprehensive Program
Granting Agency: U.S. Department of Education, Fund for the Improvement of Postsecondary Education
Grant Funding: $300,000
Role: Principal Investigator
Date: 2001-2004

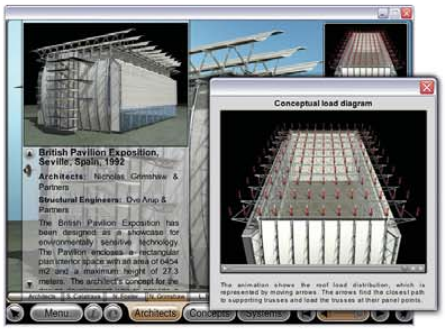
Interactive Structures: Visualizing Structural Behavior

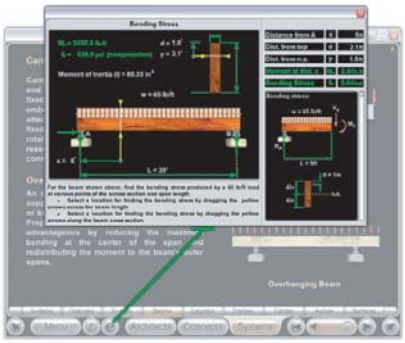
John Wiley and Sons Inc., NY, DVD Ver. 2.0 (2008), ISBN 978-0-470-26269-9
(Accessible in 65 Libraries nationally and internationally).

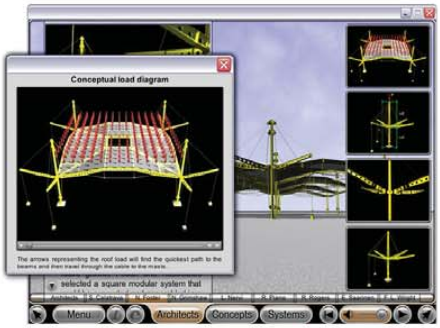
Using three-dimensional computer generated models, animations, audio narration, and interactive quizzes, this product explains the fundamentals of structural behavior and analysis in an easy-to-understand manner. Interactive Structures utilizes a multi-media format that permits users to draw a direct relationship between structural analysis theory and its practical application within existing buildings. This approach is better suited to the skills, disposition and learning needs of architecture, non-engineering and entry-level engineering students.

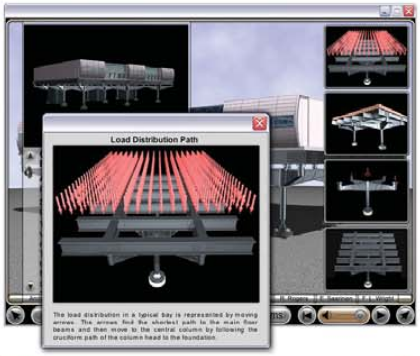


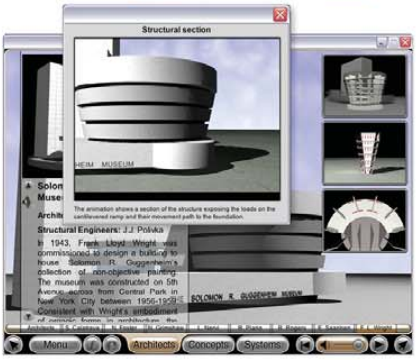


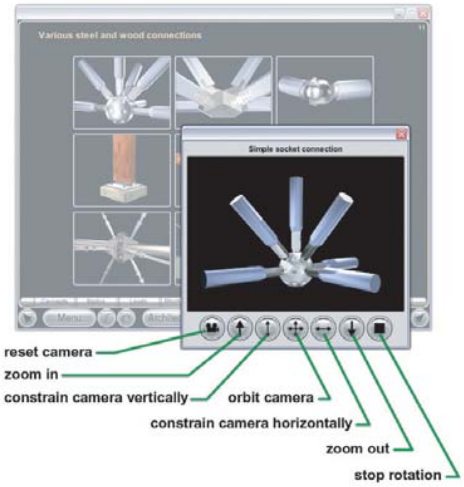


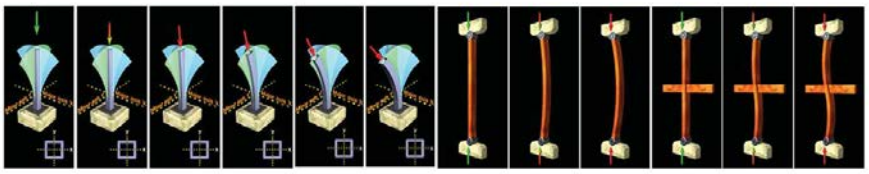


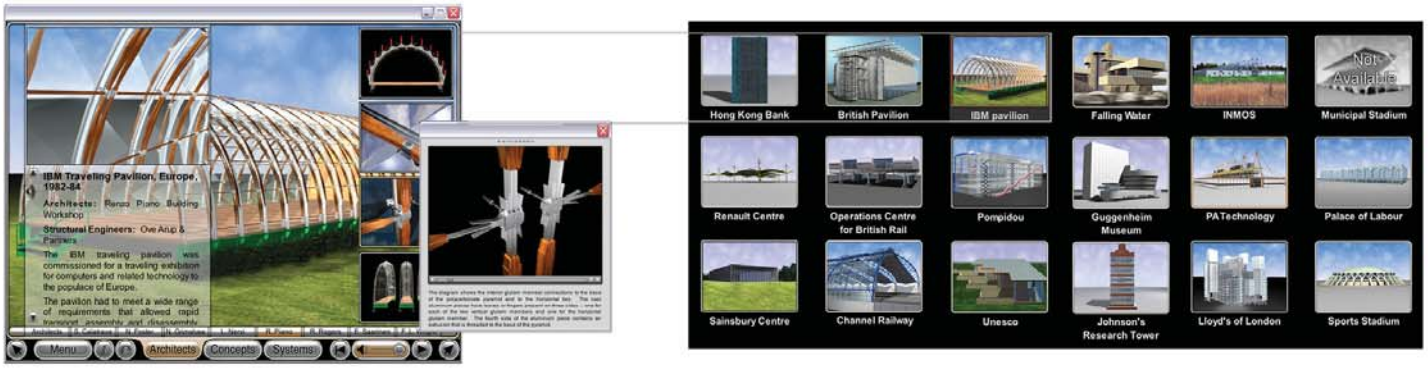


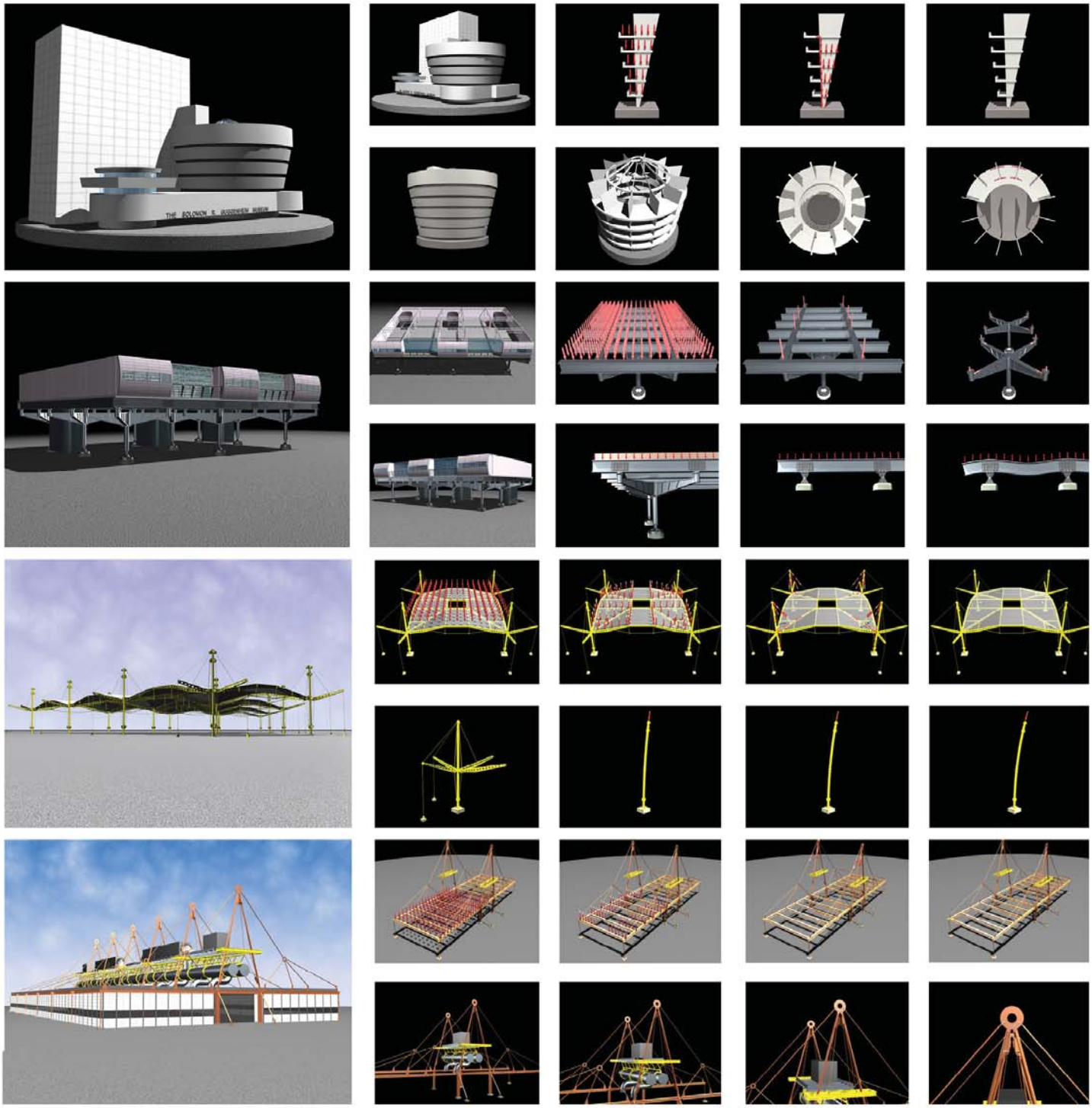


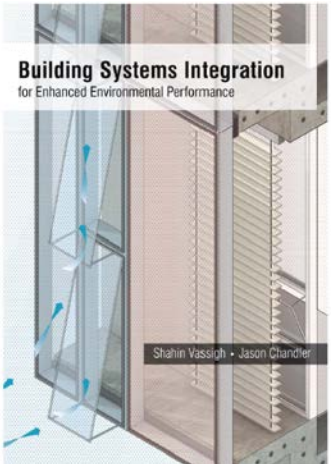







IBM Traveling Pavilion, Europe, 1982-84
Architects: Renzo Piano Building Workshop
Structural Engineers: Ove Arup & Partners
The IBM traveling pavilion was commissioned for a traveling exhibition for computers and related technology to the populace of Europe.
The pavilion had to meet a wide range of requirements that allowed rapid transport, assembly and disassembly.
Menu
Architects
Concepts
Systems
Hong Kong Bank
British Pavilion
IBM pavilion
Falling Water
INMOS
Municipal Stadium
Renault Centre
Operations Centre for British Rail
Pompidou
Guggenheim Museum
PA Technology
Palace of Labour
Sainsbury Centre
Channel Railway
Unesco
Johnson's Research Tower
Lloyd's of London
Sports Stadium





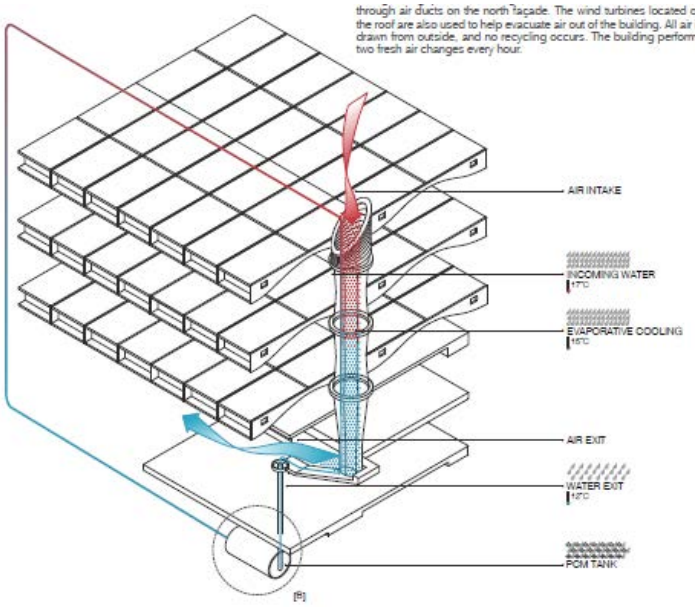
Project Title: Building Literacy: The Integration of Building Technology and Design in Architectural Education
Granting Agency: U.S. Department of Education, Fund for the Improvement of Postsecondary Education
Grant Funding: $553,000
Role: Principal Investigator, 2007-2011

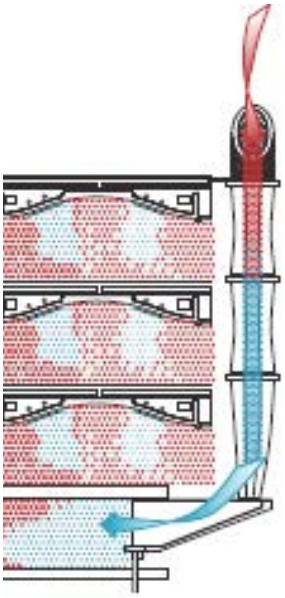
The project developed two books, a learning software, and a simulation software by harnessing the interactive capabilities of advanced digital applications such as dynamic modeling programs, interactive diagrams, animations and other visualization techniques. The project helps students to understand various building systems and their integration with visualization.

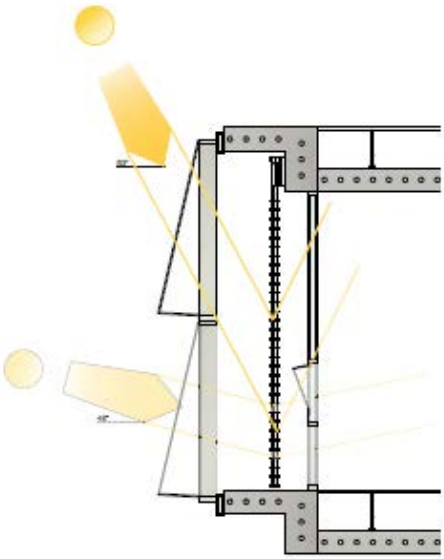
1. Building Systems Integration for Enhanced Environmental Performance

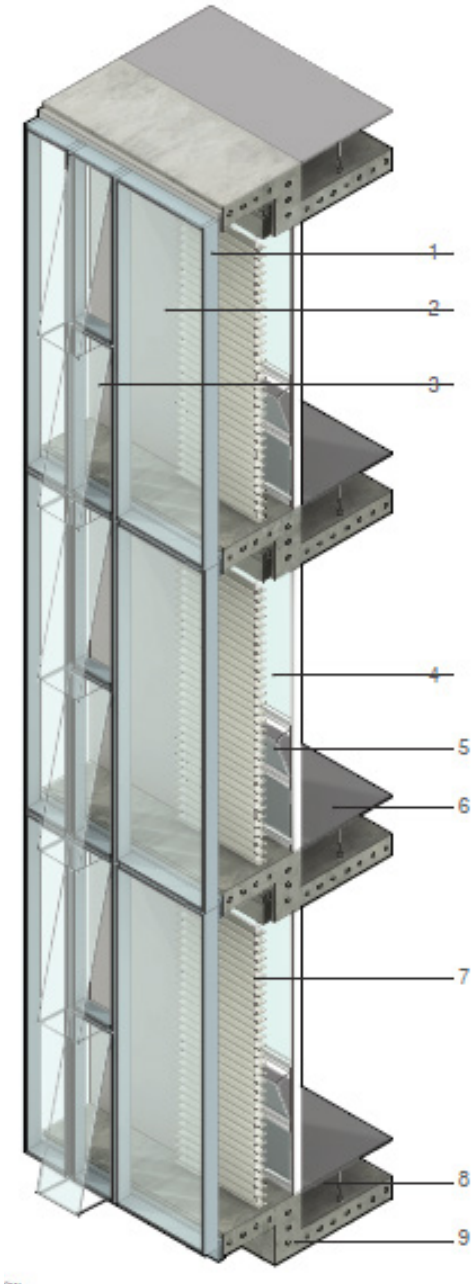
J. Ross Publishers Inc., Fort Lauderdale (2011), ISBN: 978-1-60427-015-0

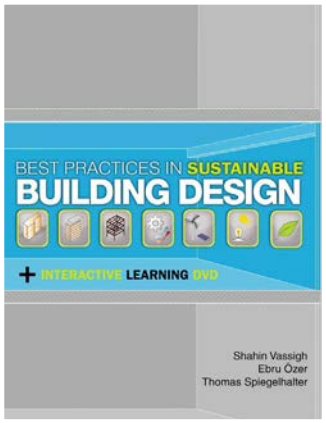
As the environmental impact of buildings becomes increasingly recognized, the role of building designers and the initial decision-making process, which determines materials, systems, and construction processes, becomes more critical. This book addresses sustainability in building design through the development of a series of case studies presented as three-dimensional models of well-integrated building systems. It incorporates an innovative and unique approach for introducing and organizing building systems into categories based on pairing of systems, their interaction, and performance metrics rather than the traditional typological organization of building systems.











2. Best Practices in Sustainable Building Design

J. Ross Publishers Inc. Fort Lauderdale (2012), ISBN: 978-1-60427-068-6

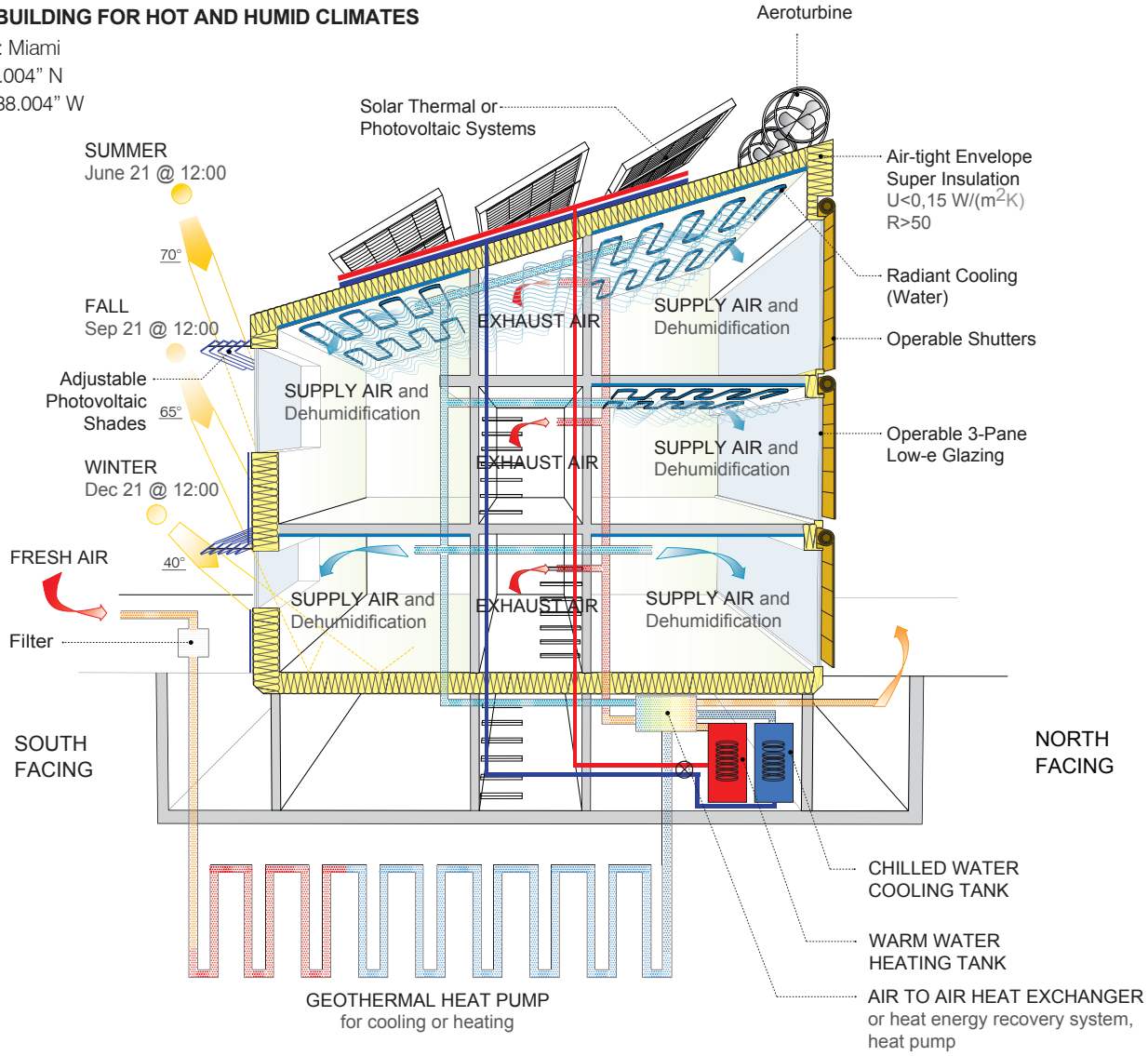
Shahin Vassigh, Ebru Özer, and Thomas Spiegelhalter

The interdisciplinary content of this book provides a wide range of information for various disciplines engaged in building design and construction by including building envelope, mechanical systems, lighting systems, landscape, and alternatibve energy sources in a unique compilation .

The book is composed of seven content areas: building form, envelopes, structures, climate control systems, renewable energy, lighting, and landscape design. Each content area is subdivided into learning modules that introduces the subject matter and investigates best practices and various strategies for climate responsive and ecologically sustainable design and construction.

PLUS ENERGY BUILDING FOR HOT AND HUMID CLIMATES

Example Location: Miami
Latitude: 25°46'26.004" N
Longitude: 80°11'38.004" W



+

3. Best Practices in Sustainable Building Design Learning Tool

J. Ross Publishers Inc. Fort Lauderdale (2012), ISBN: 978-1-60427-068-6

Shahin Vassigh, Ebru Özer, and Thomas Spiegelhalter

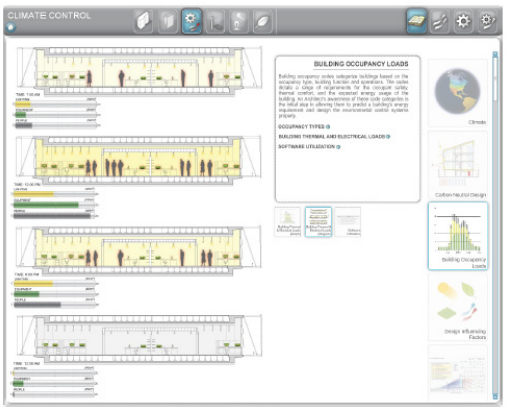
This learning software takes advantage of the interactive capabilities of state-of-the-art computing technology including hypertext functionality, animations, and open information referencing. It is highly visual, demonstrating building sustainability concepts using well detailed, realistic, 3-D computer generated models and interactive animations. This learning environment and the ccompanied text book serve a variety of learning styles by combining a traditional textbook format with multimedia graphics and interactive animations, thereby serving both those who learn better through visual media as well as those who prefer reading a book.

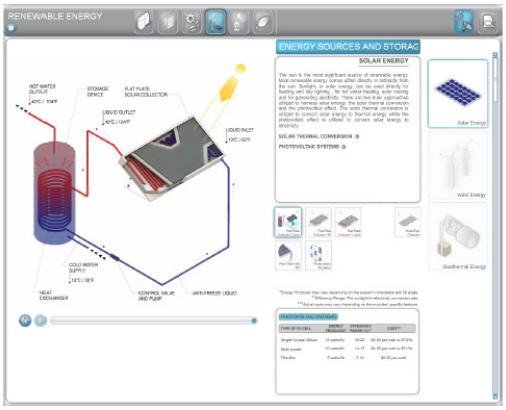
Rolling over the main navigation icons will show the titles on the lower left side. Once selected, the title will appear on the upper left side. The Home icon wil dispay the table of contents.

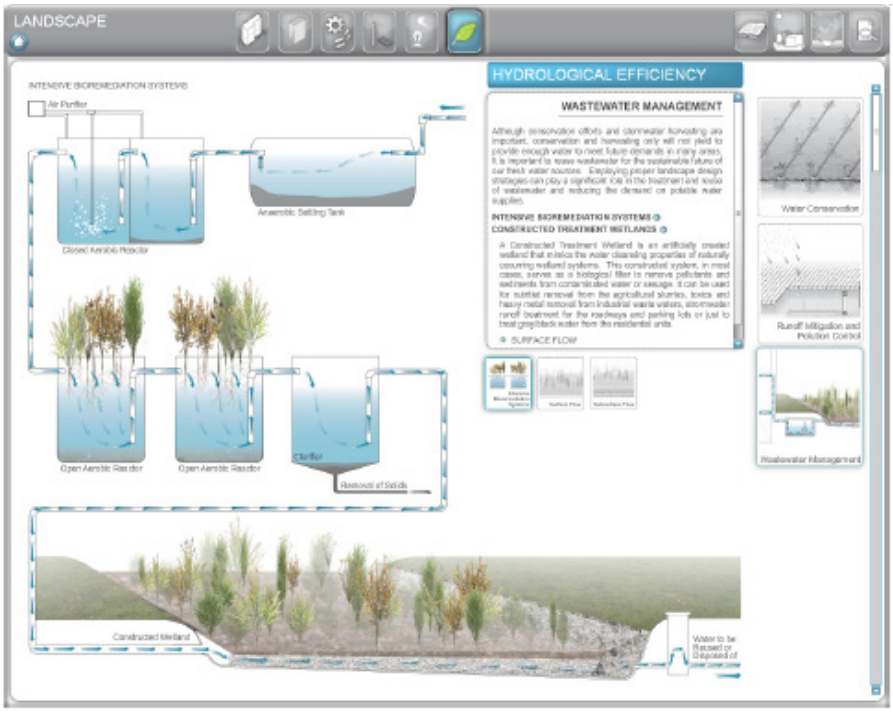
Main Navigation Icons are used for accessing various content areas

Rolling over the sub-category icons will show the title on the left side. Once selected the sub-category title will appear on the blue bar bellow.

Content categories for each Main Icon are displayed in this section



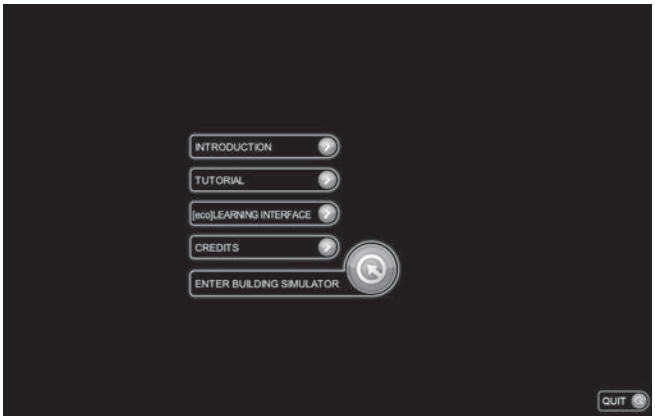


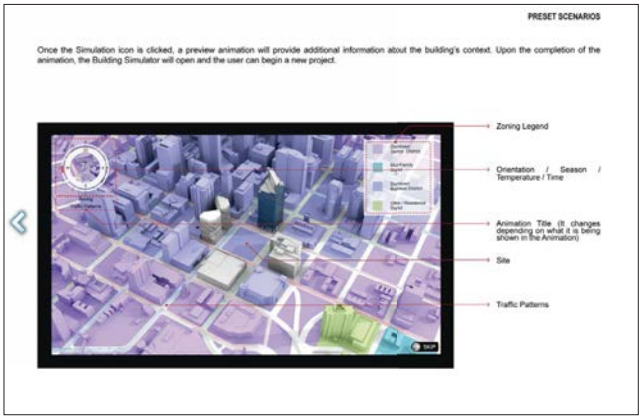


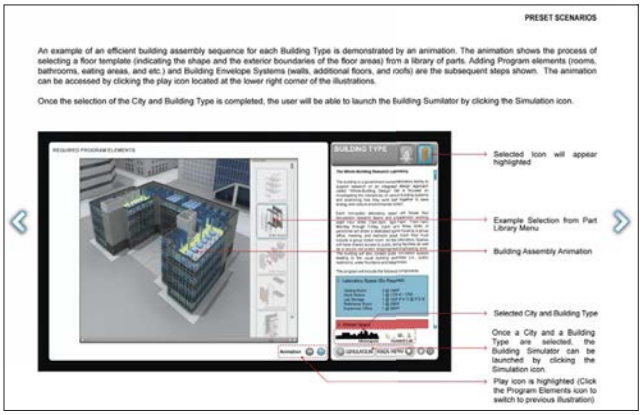
4. Building Simulator

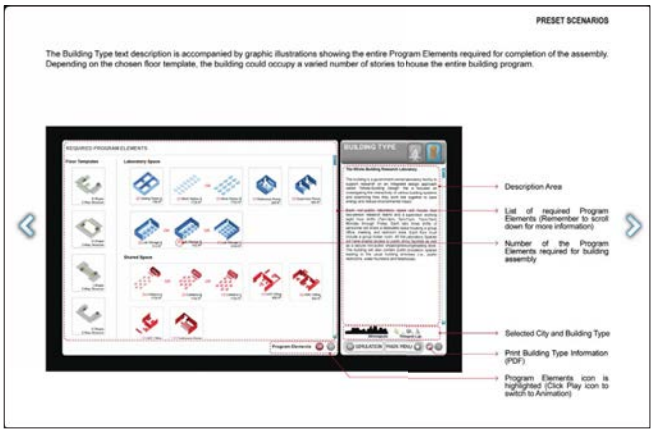
Prototype Simulation Software

The Building Simulator is a prototype software that provides access to a library of building tools containing a wide range of preconfigured building components for assembling a building. Navigating through choices, students learn about each building components and their relevant properties such as the R-Value, Embodied Energy, Embodied Water, etc. before selecting them for assembling a building. Each building component is tagged with metrics and attributes which are imported to the interface when the component is selected. Once the building is assembled, the software runs solar radiation simulation, providing a better understanding of building performance of and the selected envelope system.









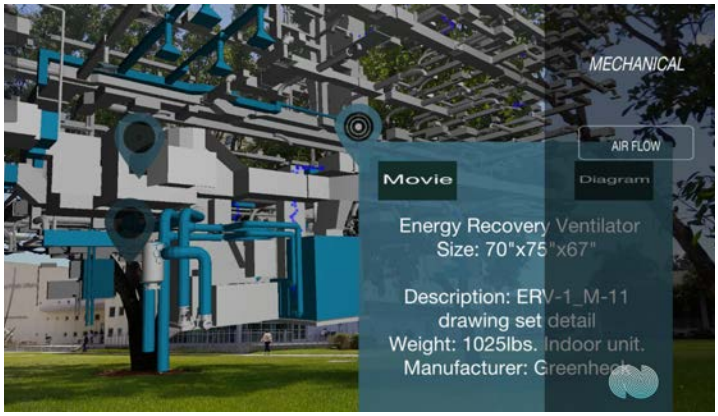
Project Title: Strategies for Learning: Augmented Reality and Collaborative Problem-Solving for Building Sciences
Funding Agency: National Science Foundation, Improving Undergraduate STEM Education: Education and Human Resources
Grant Funding: $219,000
Role: Principal Investigator
Date: 2015-2018

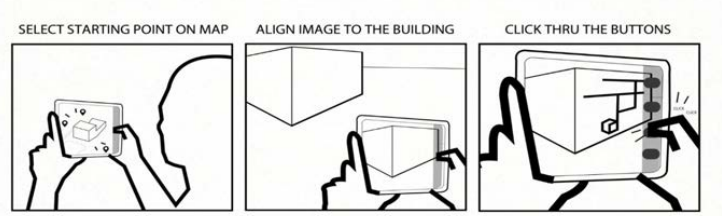
Augmented Reality and Virtual Reality Leaning Tools : AR & VR SKOPE

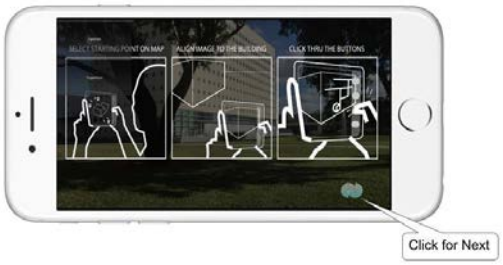
The project builds on new research that shows Technology Mediated Learning Environments can enhance learning. This project integrates Augmented Reality (AR) and Virtual Reality (VR) with Building Information Modeling (BIM), gaming engines, visual simulations, and interactive lessons to create tools for helping students better understand the complex systems and processes of building design and construction. Like having an interactive x-ray vision, students can use the AR tool to move around a building and view through the building material, looking at various components such as the façade system, structure, mechanical systems, plumbing, etc. and learn about the building onsite. The tool also includes a learning interface that delivers relevant lessons on an on-demand basis. As students view the building model on their handheld devices, they can quarry and pull up lessons on what they are observing. A VR version of the project accommodates students who cannot be physically on site.

SKOPE AR

AR - SKOPE

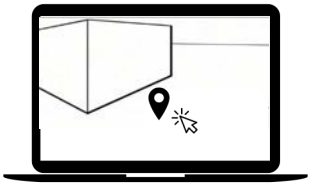


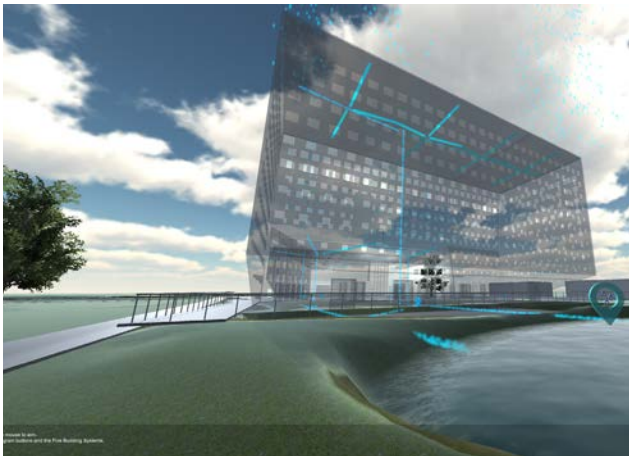




SKOPE VR

VR - SKOPE





SET LAB

Structural and Environmental Technologies Lab

Project Title: Structural and Environmental Technology Laboratory (SET Lab)
Funding Agency: Florida International University
Grant Funding: $67,000+ Building Extension
Role: Principal Investigator
Role: Principal Investigator and Co-Director
Date: 2008-Present

Structural and Environmental Technology Laboratory

SET Lab is dedicated to teaching of architectural technology with the recognition of ecological importance of sustainable, energy-conscious design, and construction. The pedagogical approach of the SET lab builds on the new educational theories that have established learning is an active and constructive process that is inherently social. To support this process, the lab facilitates student collaboration by working on a common problem with a hands-on approach using both low-tech and high-tech methods for experimentation. The structures lab sessions enhance class lectures with related exercise problems that involve making an artifact, performing analysis, and testing with both quantitative and qualitative methods.

Introduction to Structures Labs

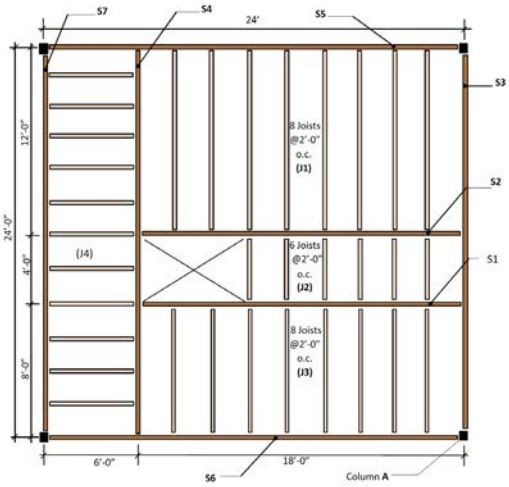
Using various strength rubber bands, students learn about Modulus of Elasticity and calculate values.

Students load and measure deflection of a beam with sand bars and compare it with hand calculations.

Using a PASCO Pulley System, students observe the resultant force and compare it with their calculations results

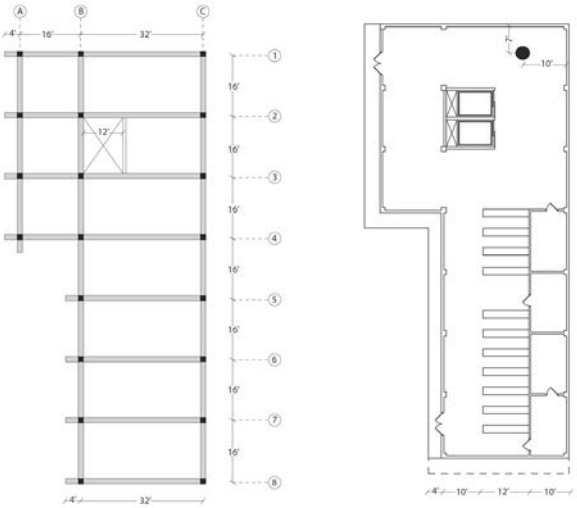
Using PASCO Kit of Parts and loading Cells students confirm the result of their hand calculations for truss systems

Wood Framing Workshop

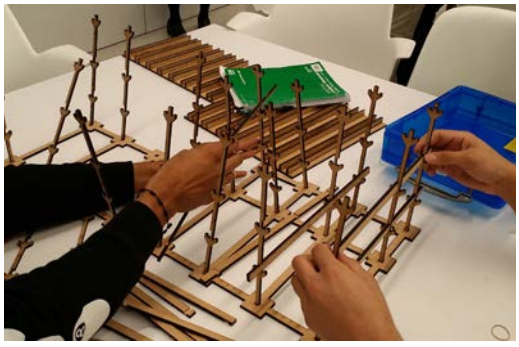


Students use laser-cut and 3D printed kit of parts to assemble a wood framed structure before calculation of member sizes.

Concrete Framing Workshop



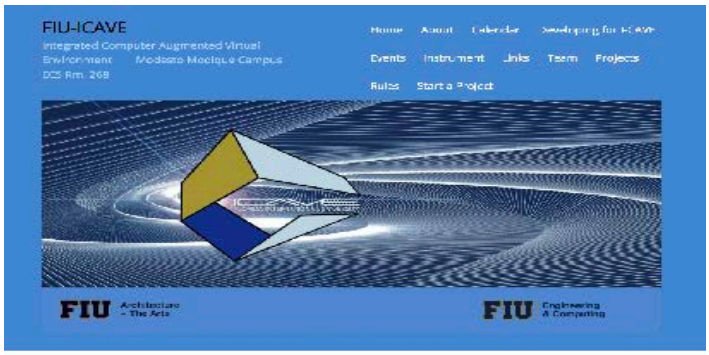
Students use laser-cut and 3D printed kit of parts to assemble a concrete structure before calculation of member sizes.

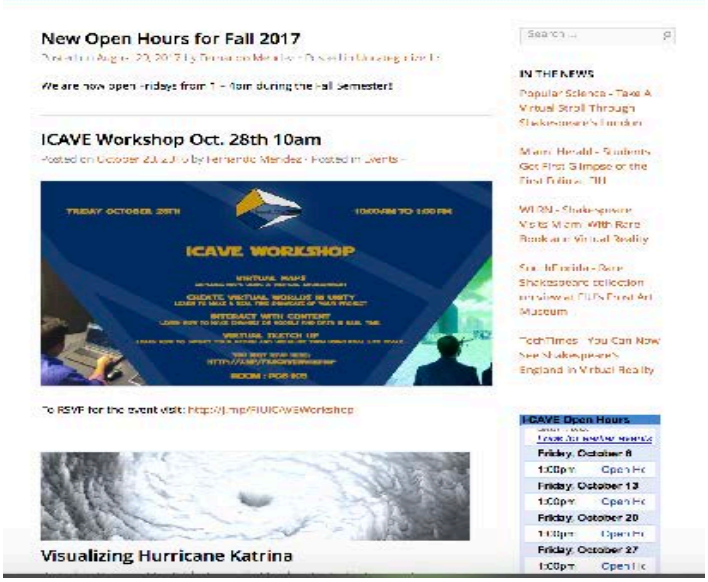


Project Title: Integrated Computer Assisted Virtual Environment
Funding Agency: Florida International University
Grant Funding: $800,000
Role: Co-Investigator and Co-Director
Date: 2015 - Present

Integrated Computer Assisted Virtual Environment (I-CAVE)

The I-CAVE is a visualization facility composed of five large, high-resolution screens arranged in a hexagonal pattern and a surround sound system that create an immersive virtual reality experience. Hardware and software tracking capabilities follow movement and coordinate with displayed images for the immersion of users in the simulated environment. This facility provides new opportunities for research, creative projects and data visualization. The I-CAVE has been established as a collaborative effort between the College of Communication, Architecture + The Arts and the College of Engineering and Computing.

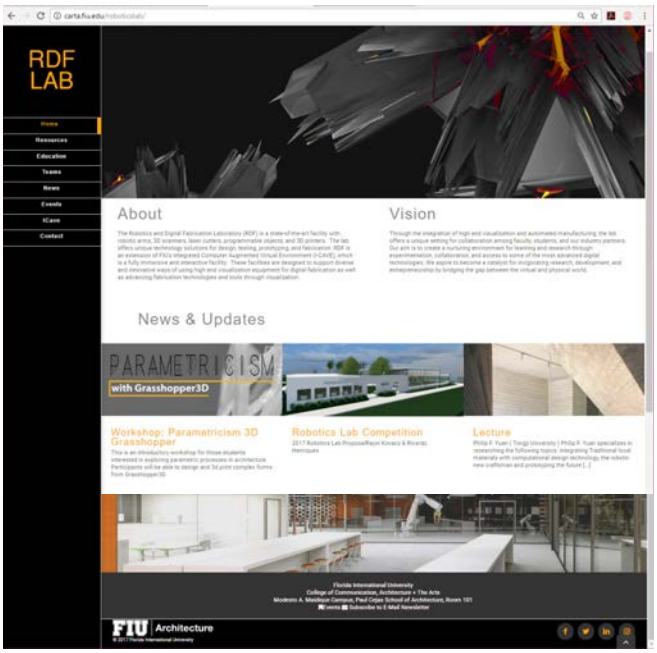




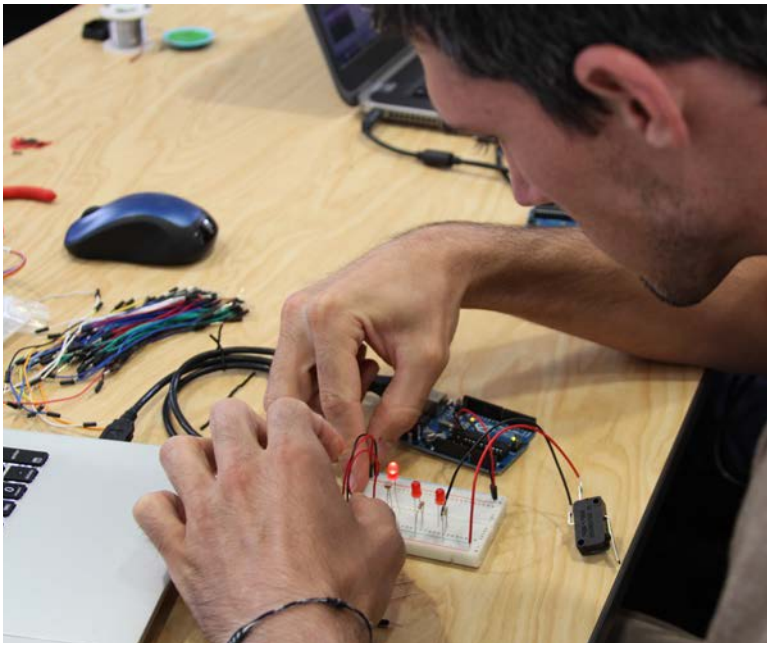
Project Title: Robotics and Digital Manufacturing Laboratory (RDF Lab)
Funding Agency: Florida International University
Grant Funding: $371,000
Role: Principal Investigator and Co-Director
Date: 2016 - Present

Robotics and Digital Fabrication laboratory (RDF Lab)

The Robotics and Digital Fabrication Laboratory (RDF) is a state-of-the-art facility with robotic arms, 3D scanners, laser cutters, programmable objects, and 3D printers. The lab offers unique technology solutions for design, testing, prototyping, and fabrication. RDF is an extension of FIU's Integrated Computer Augmented Virtual Environment (I-CAVE), which is a fully immersive and interactive facility. These facilities are designed to support diverse and innovative ways of using high end visualization equipment for digital fabrication as well as advancing fabrication technologies and tools through visualization.



roboticslab.fiu.edu



ROBOTIC ARMS

3D PRINTERS

GADGETS

STRUCTURES I
Introduction to Structures

STRUCTURES I : Introduction to Structures

Through the study of statics and strength of materials, this course provides a theoretical and scientific basis for understanding how various structural systems and materials work and withstand loads. The course is comprised of one credit-hour weekly lectures followed by 2 credit hours of lab sessions. The lab sessions are designed to enhance lectures with related exercise problems that involve making artifacts, performing analysis, and test by both quantitative and qualitative methods.

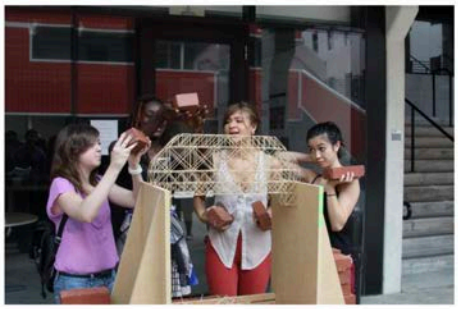
In addition to weekly labs, quizzes, homework and exams, student participate in a small-scale bridge-making contest. The competition winners are the designer of the bridge with the smallest possible weight/strength ratio.

Group Number: 1
Student(s) Name: Adam Bierman, Ludovico Ferro, Miguel Pio

Bridge Weight: 1.9oz.
Loading: 105 lbs = 1680 oz.
Strength/Weight Ratio (25 pts): **884**

Group Number: 32
Student(s) Name: Jessica Dickinson, Elizabeth Lee, Ashley Maine, Danyealah Green-Lemons

Bridge Weight: 3.1 oz.
Loading: 20lbs = 320 oz.
Strength/Weight Ratio (25 pts): **103**

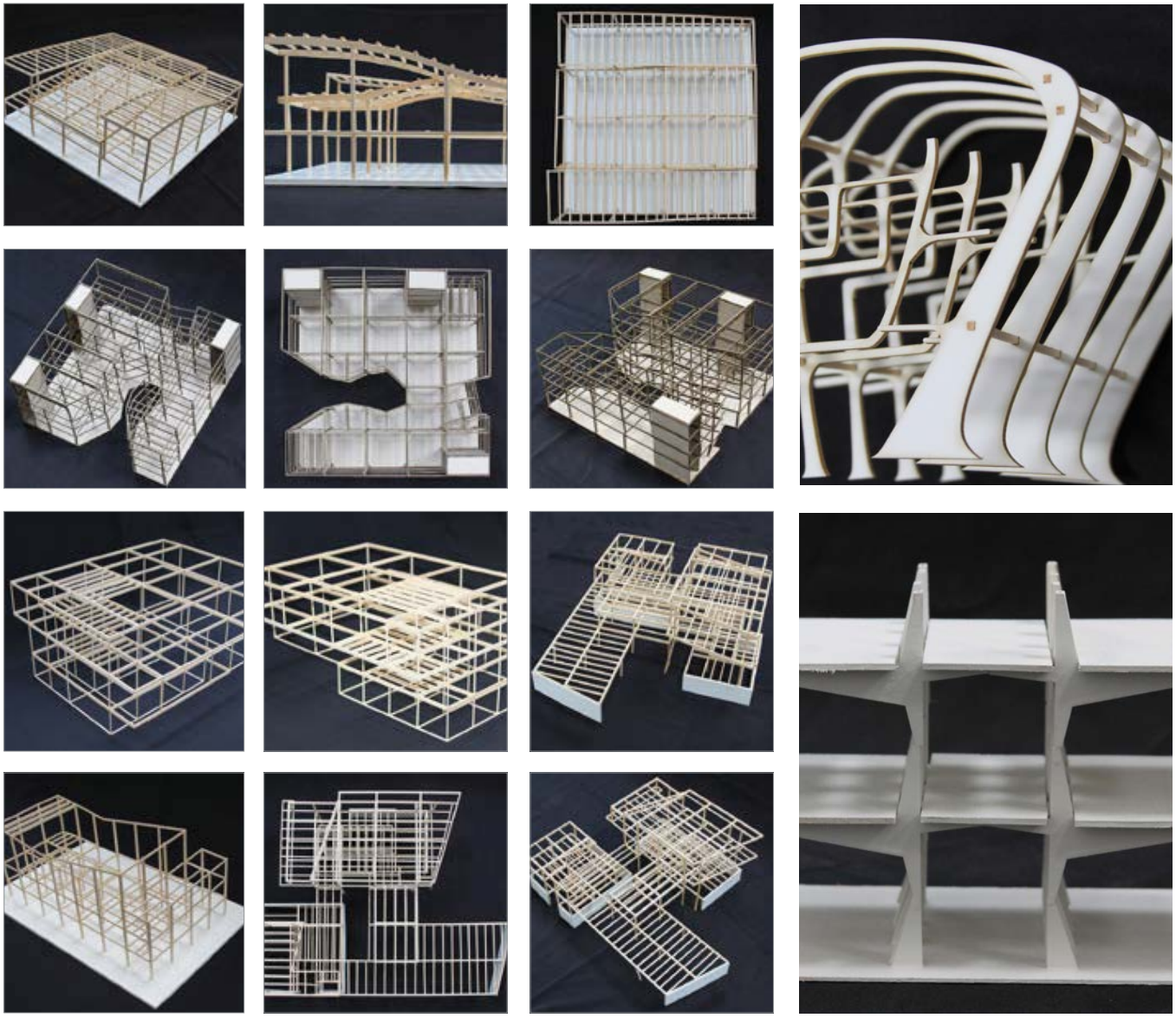


STRUCTURES II
Wood & Steel Stuctures

STRUCTURES II : Wood and Steel Structures

This course introduces fundamentals of structural analysis and design for timber and steel buildings using quantitative processes. The course content is focused on investigating various types of structural framing and sizing of building elements including beams, columns and truss members. The semester project for this course aims at integrating structures with design studios. In a coordinated effort, students bring their design projects to the structures course and develop a structural system with complete design calculations, analysis and a physical structural model.

Structural Framing for Design Studio Project



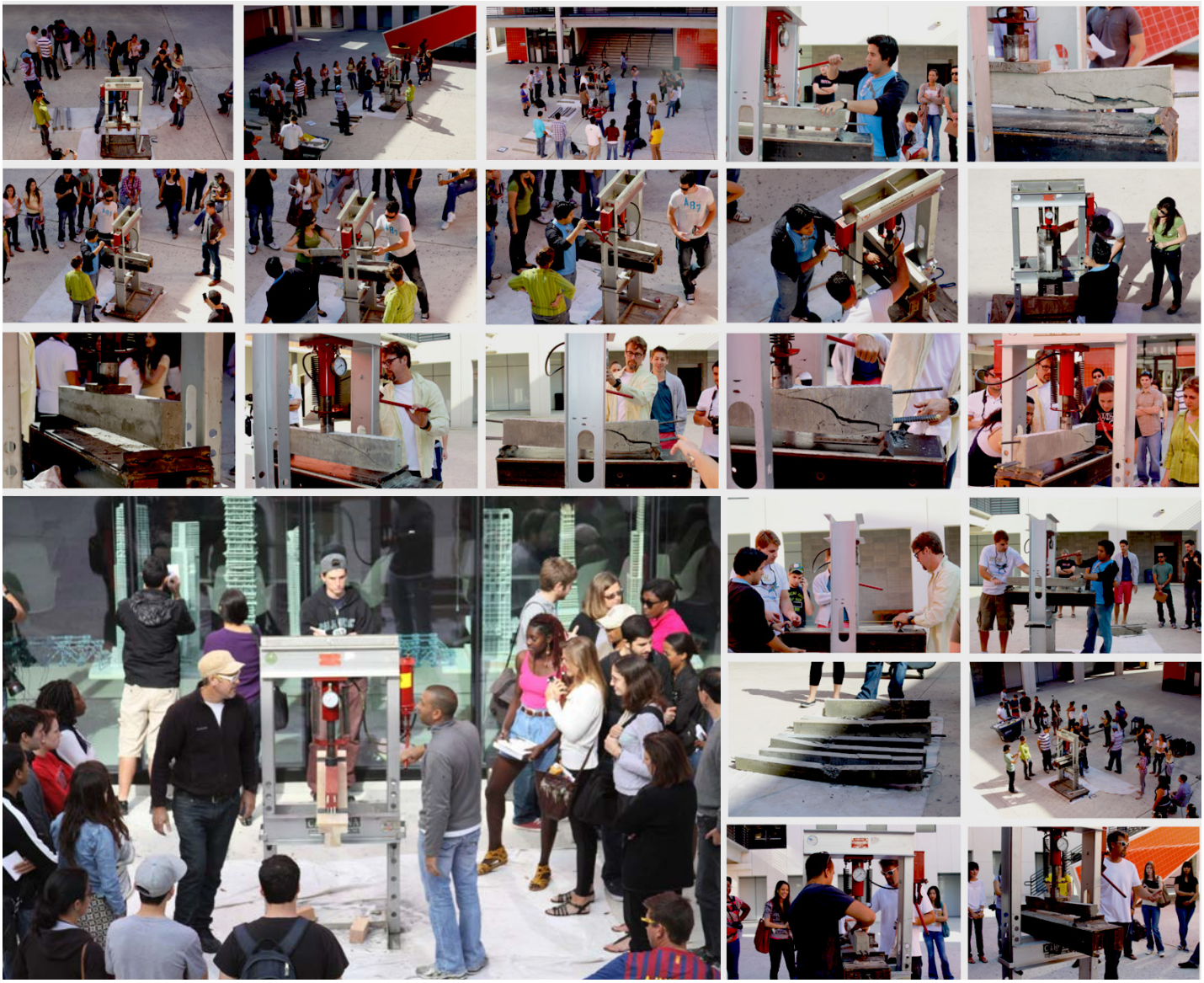
STRUCTURES III

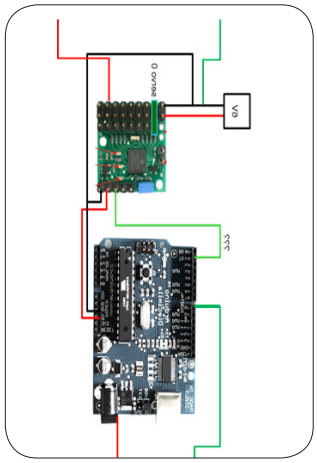
Concrete Design

STRUCTURES III : Concrete Design

The course begins with an emphasis on the investigation of reinforced concrete structures including beams, columns, and frames and continues with the study and analysis of lateral resistive systems. In addition to labs, weekly quizzes, and exams, students collaborate on a project.

Working in groups of two or three, they design of a concrete beam at full-scale and make a small-scale version of the beam for compressive testing. Students are required to place both moment and shear reinforcement in the beams prior to placing concrete and testing. All beams are tested to failure. Students observe various failure modes and document their entire calculations, form making process, and behavior the beam under loading.



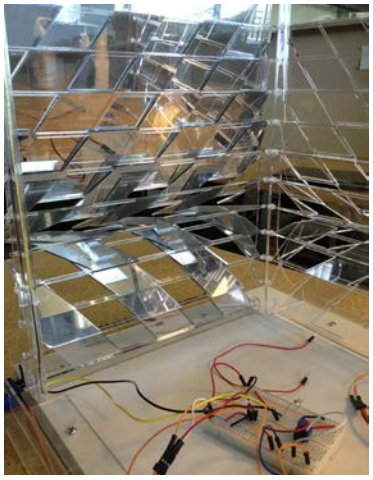


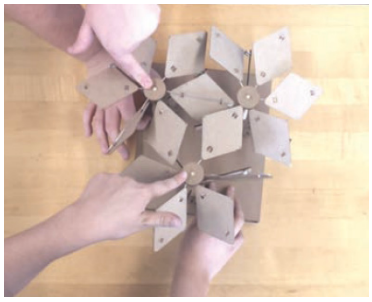
Kinetic Architecture Design Studio

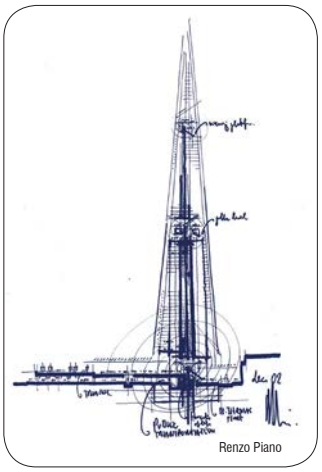
Co-taught with Erick Peterson, 2014
Co taught with Nick Gelpi, 2013

Recent technological innovations of low cost sensors and actuators have created new possibilities for design and utilization of kinetic structures. Innovators in the field are seeking to develop buildings and building components, which by physically changing in response to need, reduce demand on resources, improve function, or become multi-purpose environments.

This course explores the design and fabrication potentials of kinetic structures. Students experiment with various moving mechanisms by translating rotary motion into oscillating, reciprocal, and linear motion using Arduino open source platform. Each student designs and fabricates a prototype of a kinetic building component.







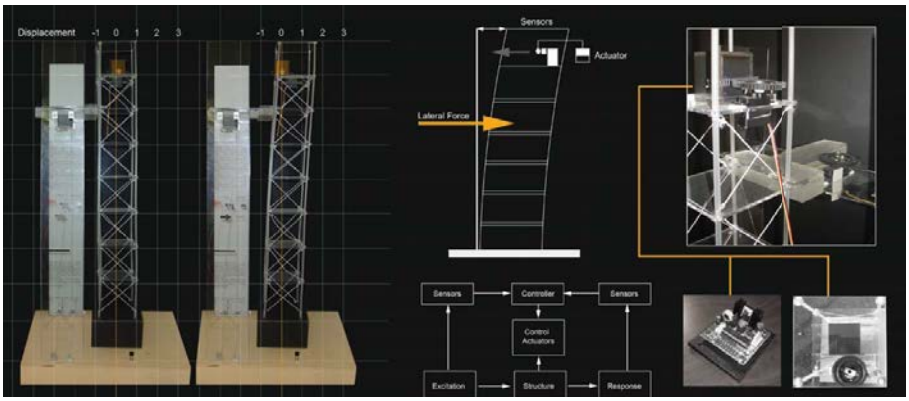
Renzo Piano

Ecology of Tall Building Design Studio

Ecological projections anticipate that the principal driver of innovation in skyscraper design will be in finding solutions to the pressing challenges posed by climate change, sea level rise, and population explosion. With new pressures on land, the appeal of suburban expansion will dissipate and vertical communities become more desirable. The need for denser construction will be fueled by pressure to move away from energy–intensive transportation and the continuous expansion of the infrastructure, that leads to the continuous loss of green space and pervious land.

This design studio called for an investigation of skyscrapers as a vehicle for finding creative solutions for ecological and urban sustainability. Students were required to propose a tall bulling with a feasible structural system, appropriate envelope for climatic conditions, adequate mechanical systems, and green space and sky gardens.

Building Models showing structure and the transpiration core



Sensors attached to structural model showing the impact of simulated lateral forces on the structure

Hands on experiment with the concept of Mass Damp Tuners