University of HUDDERSFIELD
Inspiring global professionals

Innovative Design Lab

Arts & Humanities Huddersfield

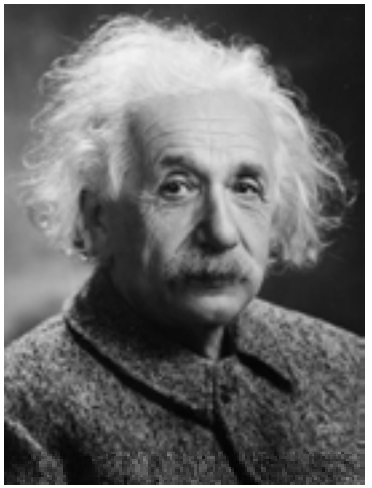
6th March 2024 at 12:00 - 12:45

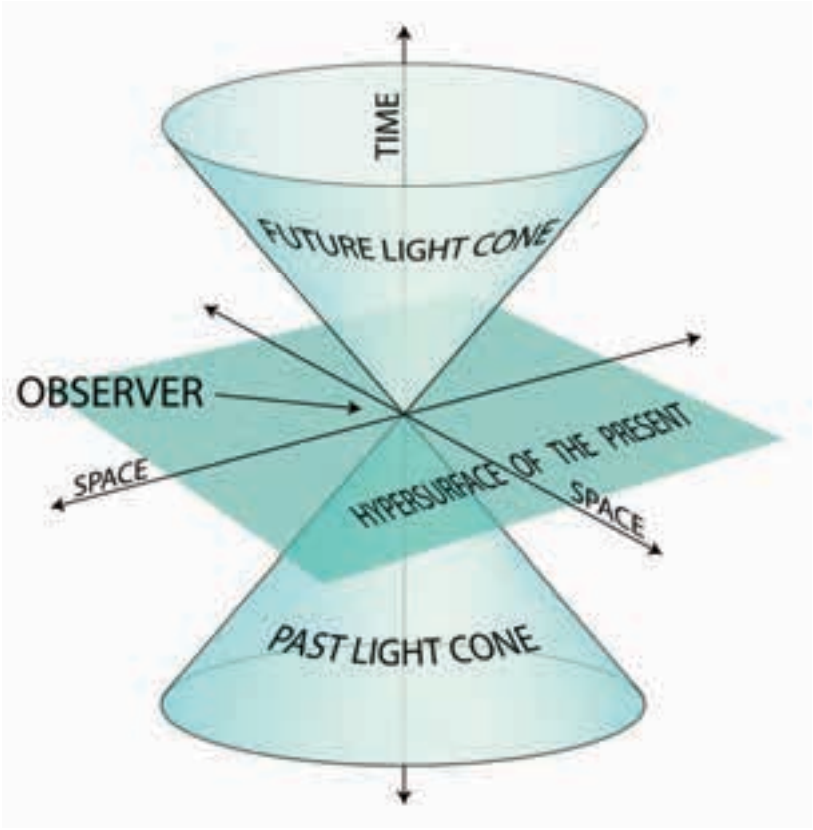
Architectural Education at Crossroads:

The path to a more sustainable future

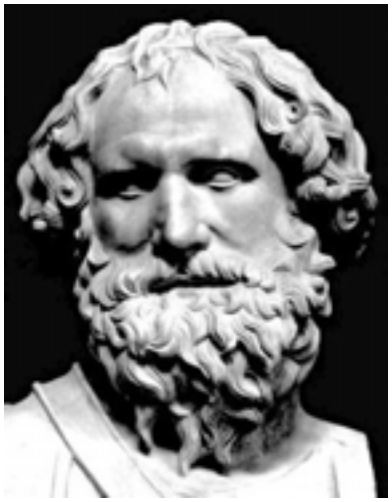
Mahjoub Elnimeiri, PhD.
Professor and Founder of the PhD in Architecture Program ,
College of Architecture, Illinois Institute of Technology, Chicago, USA

"Learn from yesterday,
live for today, hope for tomorrow.
The important thing is not to stop questioning."





Master Builder
(Art + Engineering)



The Master Builder & Physicist (mechanikoi) Isidore

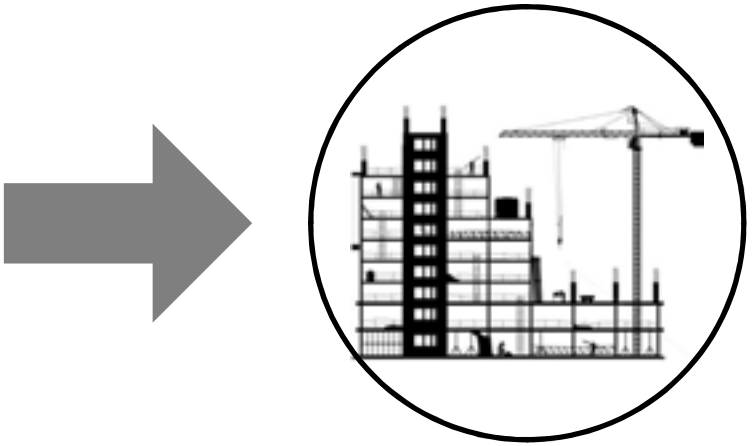
Construction finished in less than 6 years while it took nearly a century for medieval builders to construct the Notre Dame cathedral in Paris.

- Massive technological and economic changes.
- New inventions and new machines.
- The advent of new energy sources.
- The introduction of the factory system.
- Huge developments in communication and transportation means.

Transforming the societal perspective

Manual labor and animal power

Machine-based manufacturing system

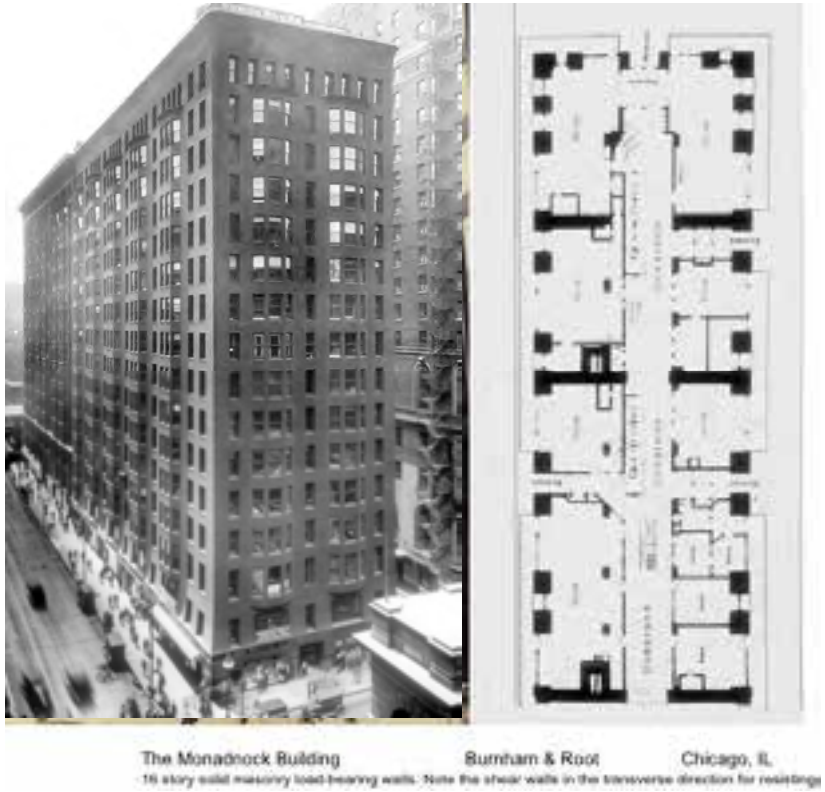


Architecture vs. Engineering

2 Paths

Great Chicago Fire, October 8th, 1871

Map of Chicago, highlighting the area destroyed by the fire



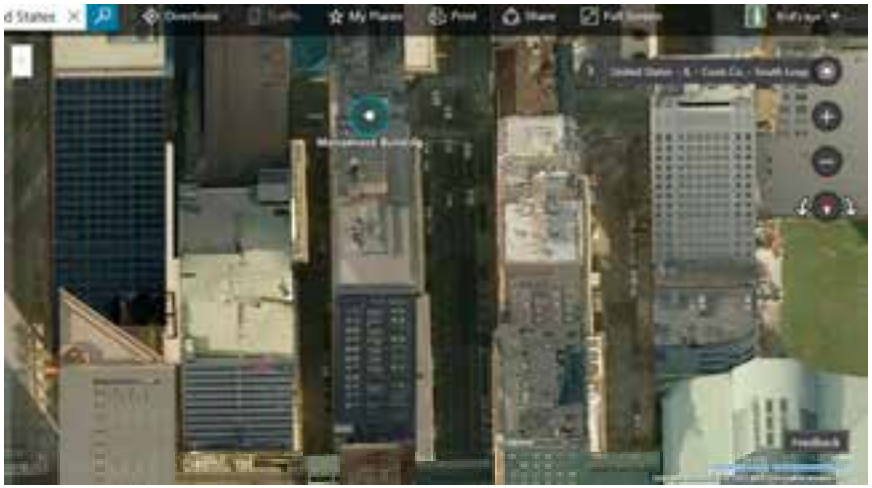
Chicago School of Architecture

Home insurance building, 1885

Daniel Burnham

Louis Sullivan

William Le Baron Jenney



Monadnock Building, Chicago, 1891

Auditorium Building, Chicago, 1889

ILLINOIS INSTITUTE OF TECHNOLOGY

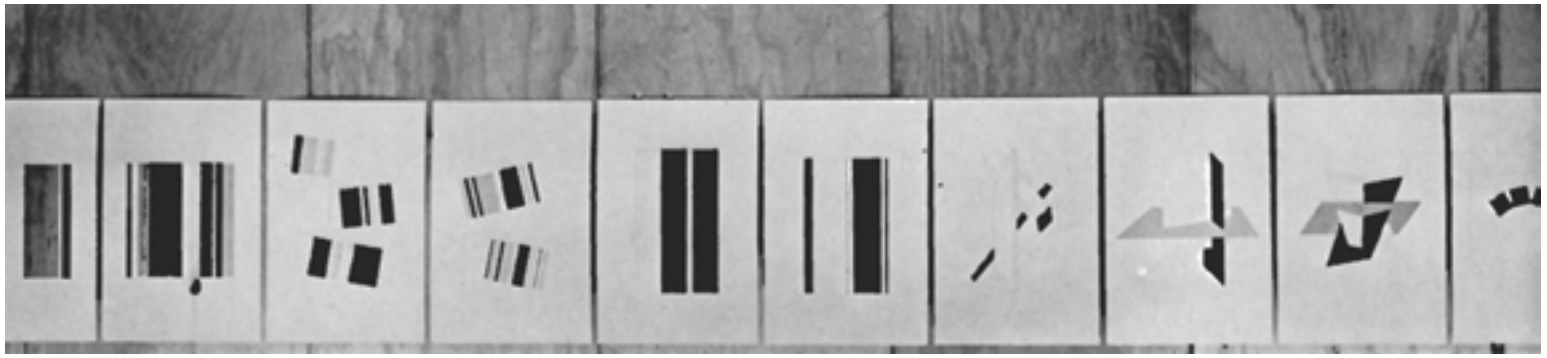
TECHNOLOGY CENTER OF TOMORROW

BACKGROUND OF VISUAL TRAINING

Visual Training was founded by Walter Peterhans c. 1940 as one of the pillars of Mies van der Rohe's educational program at IIT alongside courses in planning and construction.

Walter Peterhans

Currently, 8-10 Visual Training exercises are offered across three semesters, in Visual Training I, II, and III (ARCH 331, 332, 333).



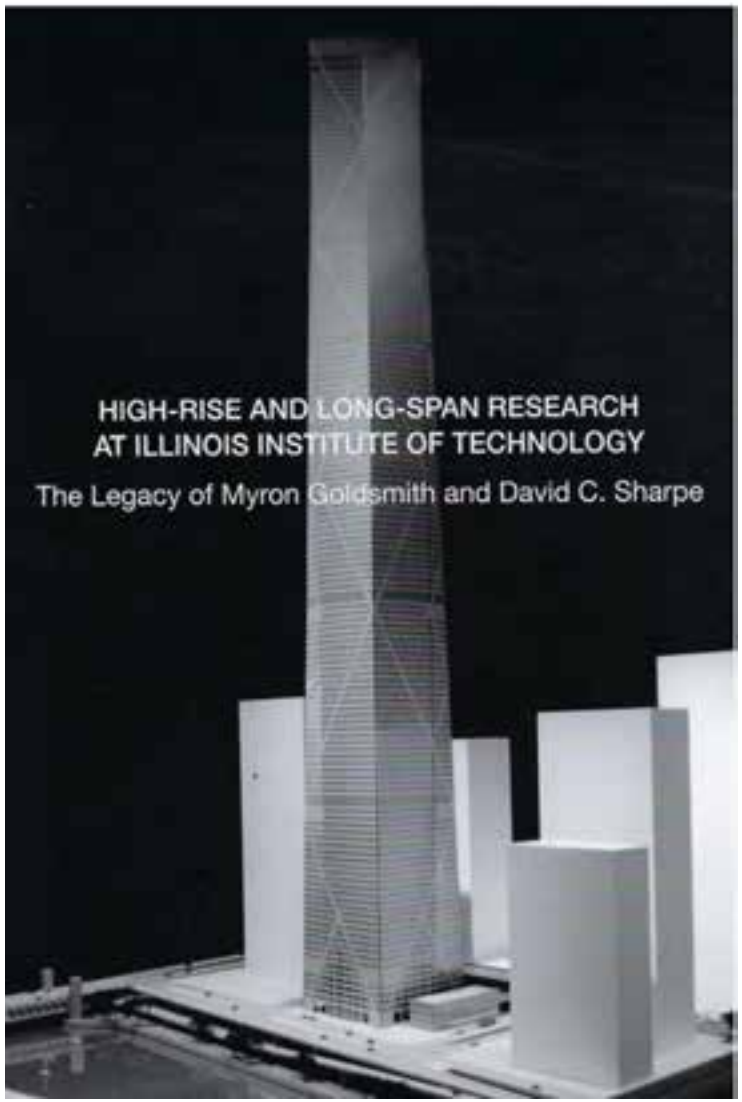
Visual Training exhibit, 1944[1]

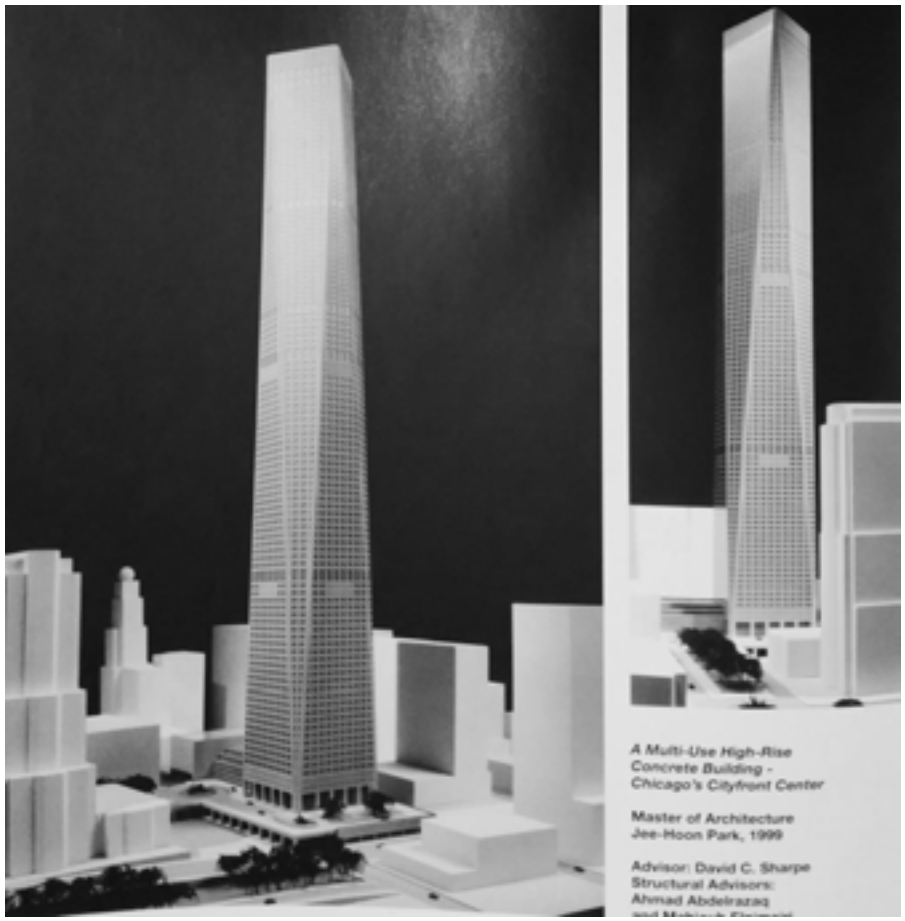
[1] Image from Howard Dearstyne,1944, "Basic Teaching of Architecture."

Images courtesy of IIT Architecture, photos by Hedrich Blessing.

"I was another local boy at a third rate Beaux-Arts School until Mies came out of nowhere and changed our lives"

The Tall Buildings: The effects of Scale

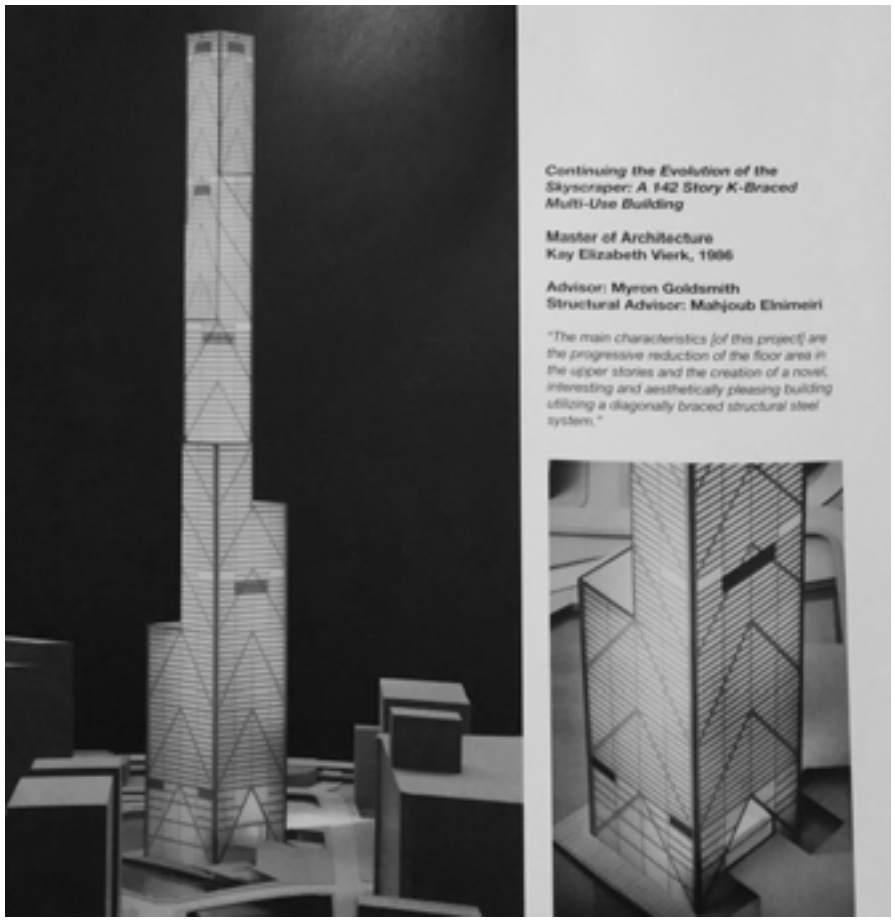

HIGH-RISE AND LONG-SPAN RESEARCH
AT ILLINOIS INSTITUTE OF TECHNOLOGY
The Legacy of Myron Goldsmith and David C. Sharpe



A Multi-Use High-Rise Concrete Building - Chicago's Cityfront Center

Master of Architecture
Jee-Hoon Park, 1999

Advisor: David C. Sharpe
Structural Advisors:
Ahmad Abdelrazaq



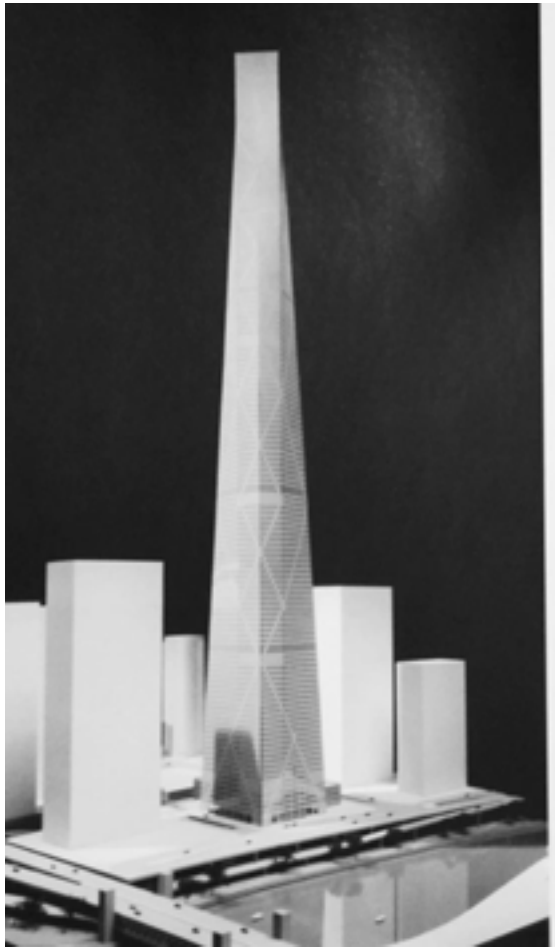
Continuing the Evolution of the Skyscraper: A 142 Story K-Braced Multi-Use Building

Master of Architecture
Kay Elizabeth Vierk, 1996

Advisor: Myron Goldsmith
Structural Advisor: Mahjoub Elnimeiri

"The main characteristics [of this project] are the progressive reduction of the floor area in the upper stories and the creation of a novel, interesting and aesthetically pleasing building utilizing a diagonally braced structural steel system."

Studio works



A Multi-Use Ultra-Tall Concrete Building

Master of Architecture
Hunseock Shin, 1999

Advisor: David C. Sharpe
Structural Advisor:

A Form-Stiffened High-Rise Apartment Building

Master of Science in Architecture
Alfonso M. Rodriguez, 1970

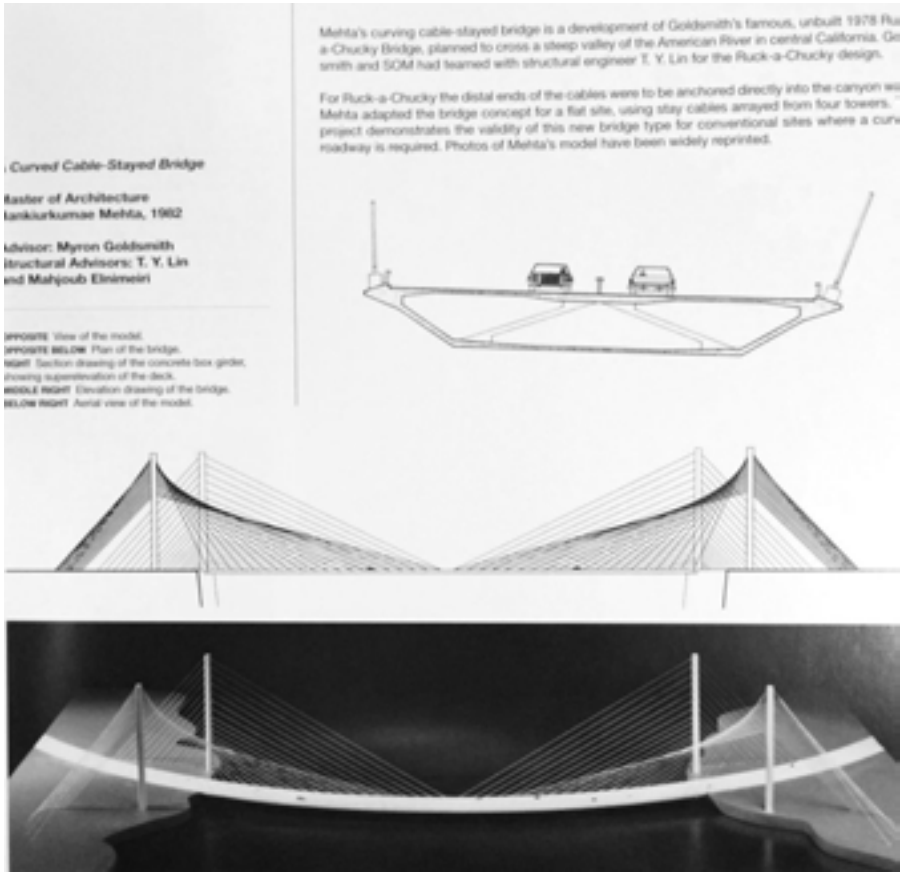
Advisor: Myron Goldsmith
Structural Advisor: Fazlur Khan

"This project suggests that a structure can be large without becoming oppressive, playful without becoming arbitrary, respect economic realities without succumbing to them, and attempt beauty without resorting to cosmetics."

Rodriguez began what he called his "form-stiffened high-rise" at Cooper Union under John Hejduk. Hejduk suggested that he transfer to IIT to pursue the project with Goldsmith.

Rodriguez's idea was that buildings more than about eight times taller than their narrowest plan dimension could be stiffened by a "shaped form" that effectively widened the base. As a test, he selected a residential tower with a single-loaded corridor "because it is probably the one that generates the least building width." His serpentine, 34-foot-wide building is, due to its form, twice the normally allowable height, in this case 60 stories. The geometry is structurally efficient and visually compelling.

Studio works



Curved Cable-Stayed Bridge

Master of Architecture
Jankisurkumar Mehta, 1982

Advisor: Myron Goldsmith
Structural Advisors: T. Y. Lin
and Mahjoub Elnimeiri

OPPOSITE View of the model.
OPPOSITE BELOW Plan of the bridge.
RIGHT Section drawing of the concrete box girder, showing superelevation of the deck.
MIDDLE RIGHT Elevation drawing of the bridge.
BELOW RIGHT Aerial view of the model.

Mehta's curving cable-stayed bridge is a development of Goldsmith's famous, unbuilt 1978 Ru
a-Chucky Bridge, planned to cross a steep valley of the American River in central California. Go
smith and SOM had teamed with structural engineer T. Y. Lin for the Ruck-a-Chucky design.

For Ruck-a-Chucky the distal ends of the cables were to be anchored directly into the canyon wa
Mehta adapted the bridge concept for a flat site, using stay cables arrayed from four towers.
project demonstrates the validity of this new bridge type for conventional sites where a curv
roadway is required. Photos of Mehta's model have been widely reprinted.

Wolf Point Center:
A Multi-Function Tall Building

Master of Architecture
Joseph John Renn, 1990

Advisor: David C. Sharpe
Structural Advisors:
Mahjoub Elnimeiri
and William F. Baker, Jr.

"The exterior truss all-steel system allowed for column-free interior spaces. This was achieved through the system's ability to transfer all of the lateral and portions of the gravity loads to the perimeter of the building. The optimum angle for diagonal bracing is 45 degrees, and this was maintained throughout the entire system."

Studio works

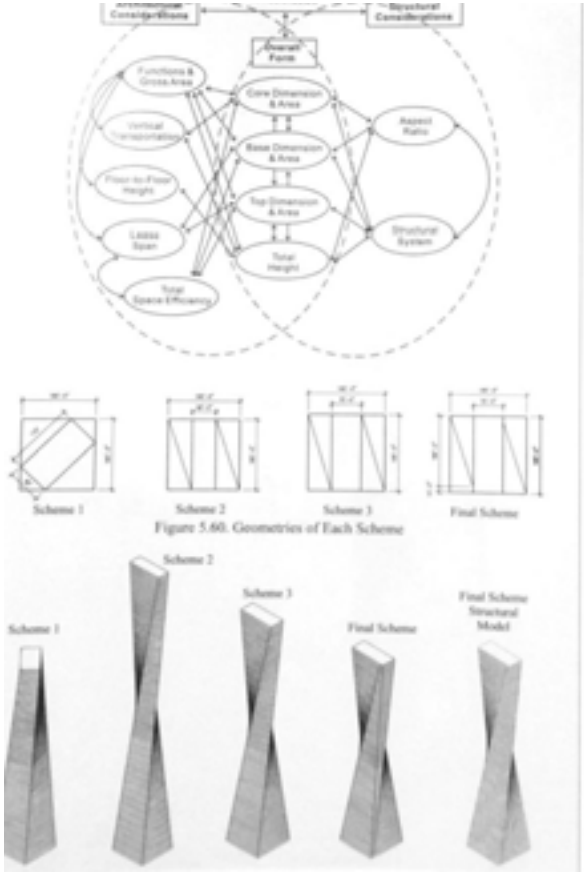


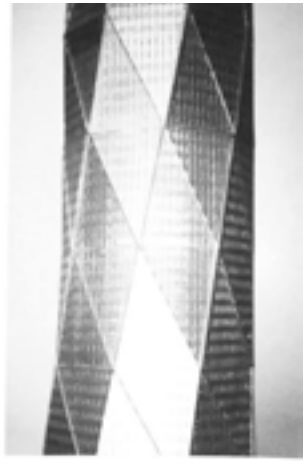
Figure 5.60. Geometries of Each Scheme

Tall Building Form Generation by Parametric Design Process

Doctor of Philosophy
Sang Min Park, 2005

Advisors: David C. Sharpe, Mahjoub Elnimeiri and Robert Krawczyk

"Various tall building forms can be generated using AutoLisp programming as a computing tool. The results are similar to hand sketches of a traditional design process. The difference is that precise forms can be generated and manipulated in a very short time based on



Mixed Use High-Rise Building at Chicago

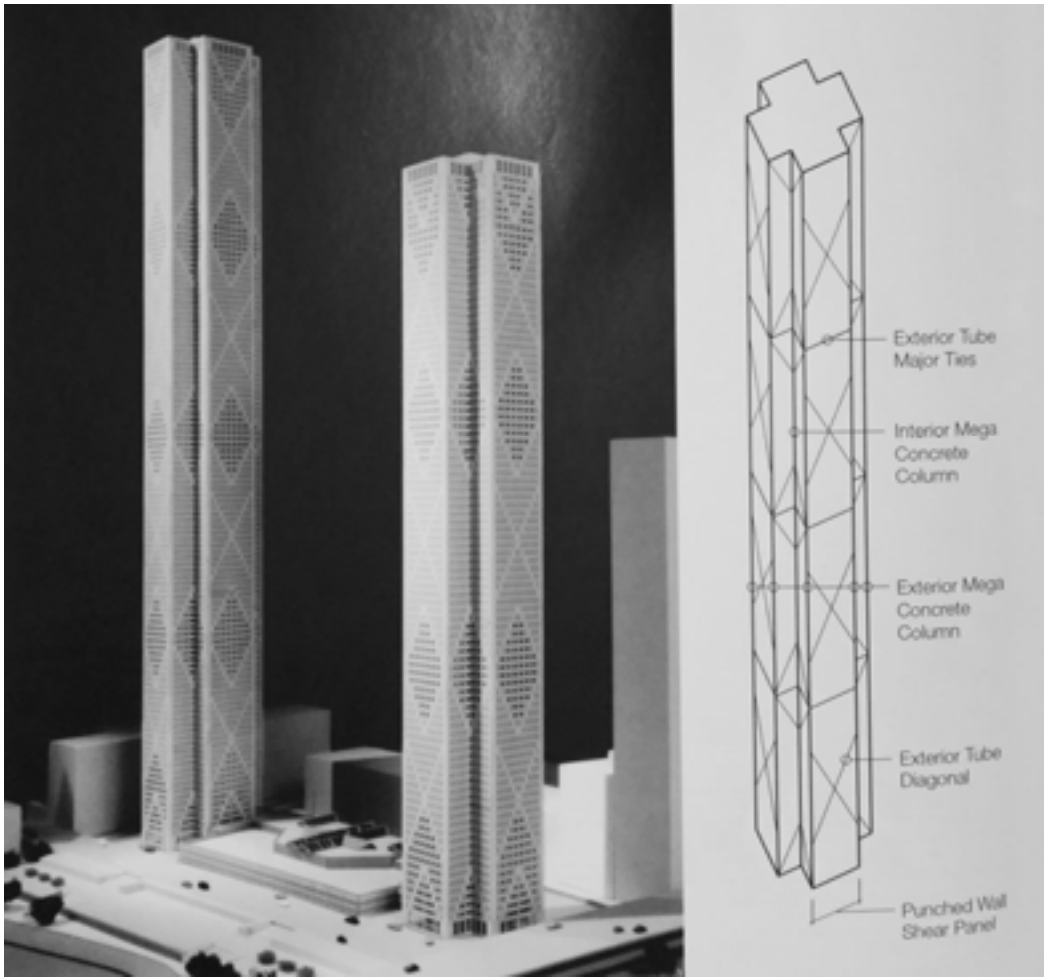
Master of Architecture
Dongwoo Lee, 2009

Advisor: David C. Sharpe
Structural Advisor: Mahjoub Elnimeiri

Dongwoo Lee reinterpreted Santiago Calatrava's Chicago Spire in this elegant (or extravagant) tower. The concrete structure is an outrigger system with concrete core. The exterior columns are round and are set in from the slab edge by from one to a few feet. Each column is canted toward the plan centroid, generating the modestly tapered form.

By adjusting the slab cantilever on a per-floor basis, Lee created an exterior [illegible] of triangular wall sections that each remain in plane. This

Studio works



Studio work

Onterie Center

Mixed-Use Development

Master of Architecture
Chira Usanachitt, 1988

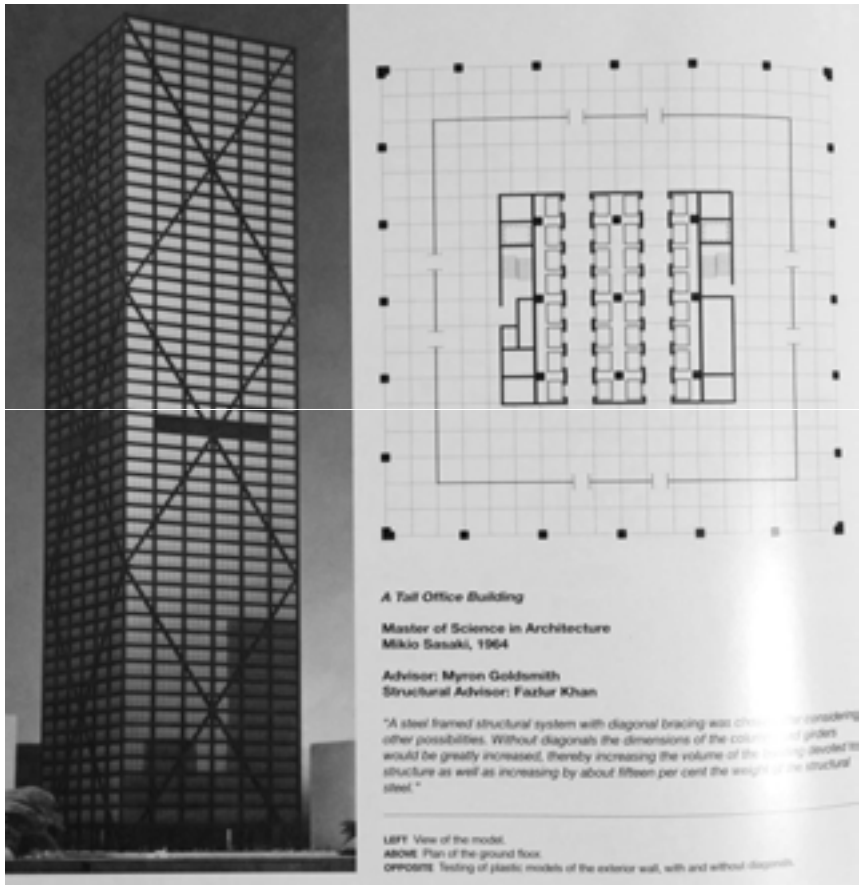
Advisor: David C. Sharpe
Structural Advisors:
Mahjoub Elnimeiri
and William F. Baker, Jr.

"The mixed-use concept integrates living, working, entertainment and recreation entitie into a single large structure. Using only mini- mal site area, mixed-use buildings can accom modate significant populations. They have th potential to reenergize urban life in the down town core."

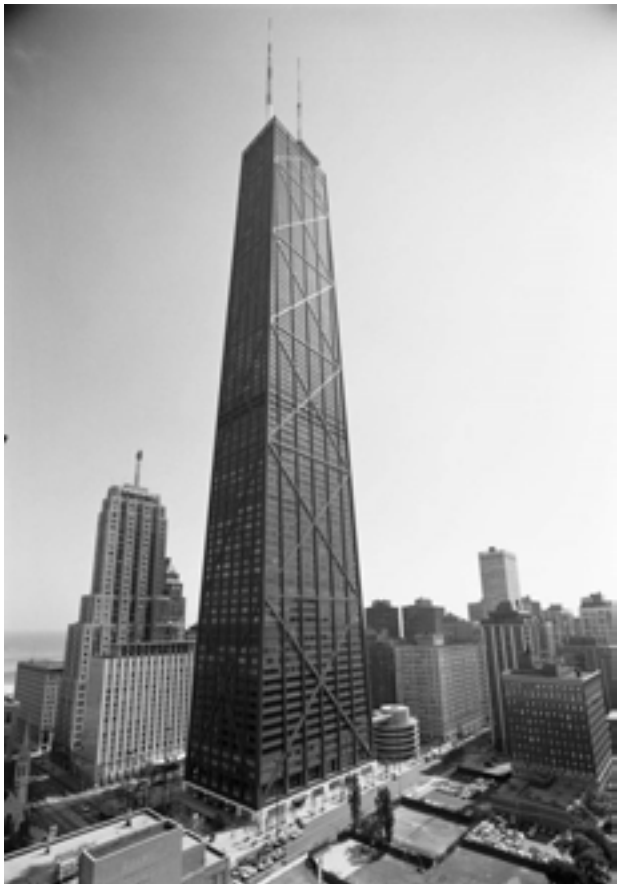
THIS PAGE Views of the model.
OPPOSITE LEFT Ground floor plan of the mixed- building, showing interior circulation threaded thro and around the five structural tubes.
OPPOSITE RIGHT Views of the model.

Studio work

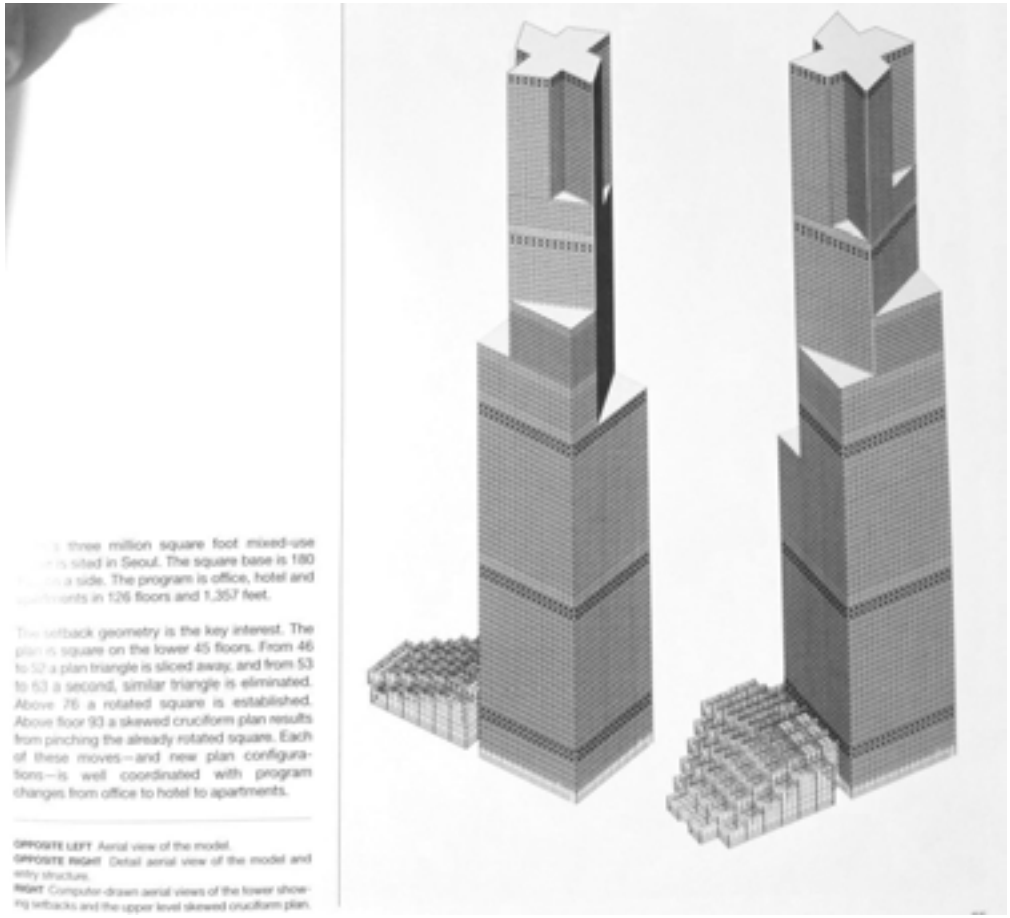
One magnificent mile



Studio work



John Hancock Center



three million square foot mixed-use
is sited in Seoul. The square base is 180
a side. The program is office, hotel and
ents in 126 floors and 1,357 feet.

The setback geometry is the key interest. The plan is square on the lower 45 floors. From 46 to 52 a plan triangle is sliced away, and from 53 to 63 a second, similar triangle is eliminated. Above 76 a rotated square is established. Above floor 93 a skewed cruciform plan results from pinching the already rotated square. Each of these moves—and new plan configurations—is well coordinated with program changes from office to hotel to apartments.

OPPOSITE LEFT Aerial view of the model.
OPPOSITE RIGHT Detail aerial view of the model and entry structure.
RIGHT Computer-drawn aerial views of the tower showing setbacks and the upper level skewed cruciform plan.

Studio work

Sears/Willis Tower

structural engineering

noun

Definition of STRUCTURAL ENGINEERING

: a branch of civil engineering dealing primarily with the design and construction of structures (such as bridges, buildings, dams)

mechanical engineering

noun

Definition of MECHANICAL ENGINEERING

: a branch of engineering concerned primarily with the industrial application of mechanics and with the production of tools, machinery, and their products

—mechanical engineer noun

dentist

noun | den·tist | \'den-təst\

Examples: DENTIST in a sentence

Definition of DENTIST

: one who is skilled in and licensed to practice the prevention, diagnosis, and treatment of diseases, injuries, and malformations of the teeth, jaws, and mouth and who makes and inserts false teeth

Dilemma of Today

How about Architecture as a profession?


121 DEFINITIONS OF ARCHITECTURE
arch daily

"Architecture is really difficult. I realized that only very recently. It's like music. You can enjoy it but — to know it — it's a different story." - Diana Agrest in nprEd

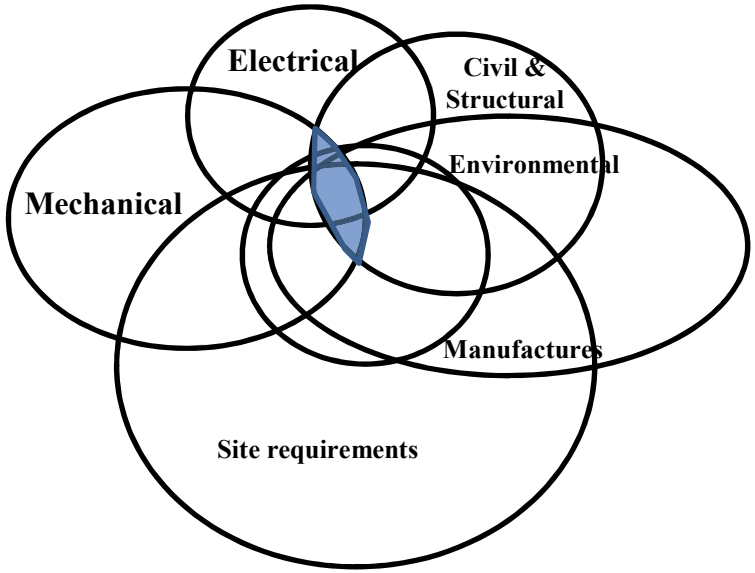
"Architecture is expected to carry too much weight in many cases." - Patricia Patkau in *Globe and Mail*

"Architecture is a kind of urban ballet." - Aaron Betsky in *New York Times*

"Architecture is a history of style written by the victors." - Herbert Muschamp in *New York Times*

"Architecture is not always synonymous with building." - Francisco "Patxi" Mangado

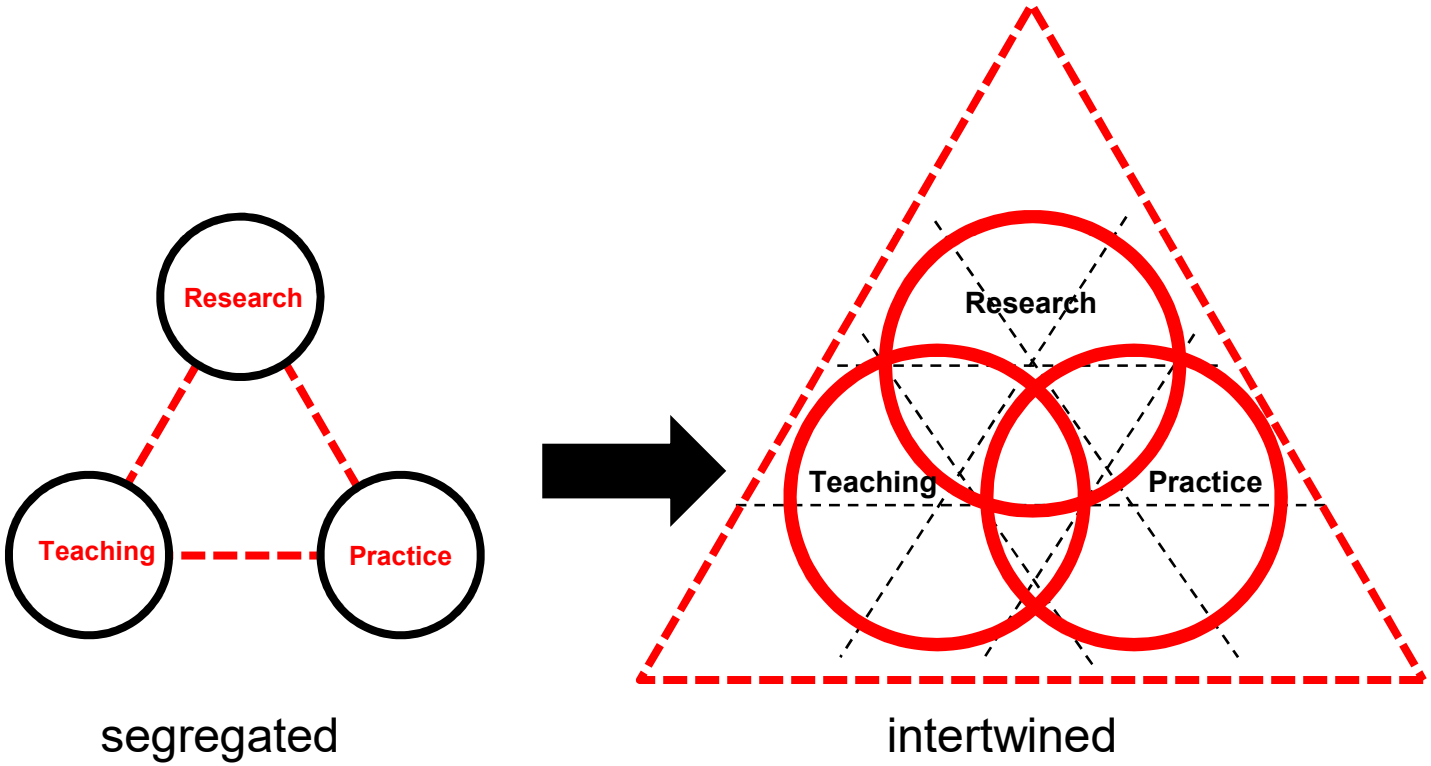
Architectural Education & the Future ???



Architectural practice engages multidisciplinary teams of professionals

Need for a Collaborative approach in Architectural Education

Architectural Education also should encourage this engagement with a multidisciplinary faculty (from engineering, science, business, law, psychology, etc…)

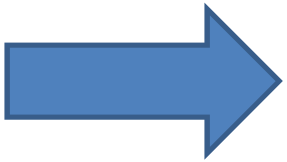


segregated

intertwined

TYPES AND PURPOSE OF THE ARCHITECTURAL RESEARCH?

- Qualitative Research.
- Correlational Research.
- Experimental Research.
- Simulation Research.
- Case study/mixed Research.
- History and Theory.



Architectural Research Topic (The Built Environment)

Incorporating Structure of Tall Buildings

Ayman Al-Musharaf, PhD candidate

Institution: Illinois Institute of Technology
Professor: Dr. Mahjoub Elnimeiri
Studio: IIT PhD Structure Sustainability & Form

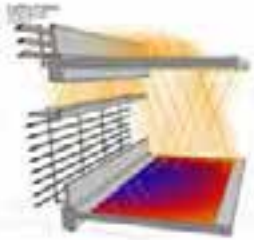
Thesis research

PhD Design Research Studio
Structure, Sustainability & Form
Illinois Institute of Technology, Dr. Mahjoub Elnimeiri

The theme of this studio is centered on rejecting high-rise design as merely iconic sculptural form-finding, and instead creating tall buildings that respond to, the unique climate, culture and context of their location.

PhD Design Research Studio
Computational Architecture
Illinois Institute of Technology, Robert J. Krawczyk

The theme of this studio is centered on rejecting high-rise design as merely iconic sculptural form-finding, and instead creating tall buildings that respond to, the unique climate, culture and context of their location.



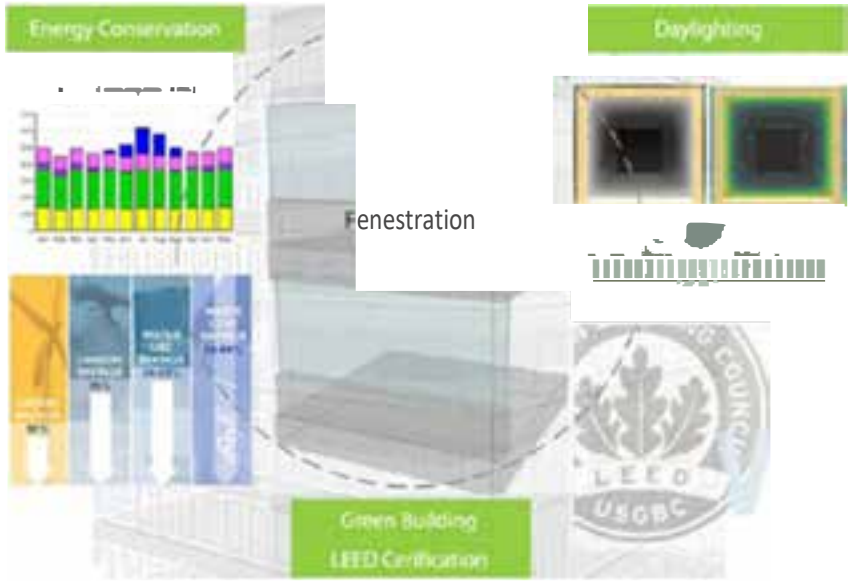
PhD Design Research Studio
Energy Efficiency
Illinois Institute of Technology, Raymond Clark, Dong-Hwan Ko, Varkie Thomas & Dr. Mahjoub Elnimeiri

The theme of this studio is centered on rejecting high-rise design as merely iconic sculptural form-finding, and instead creating tall buildings that respond to, the unique climate, culture and context of their location.

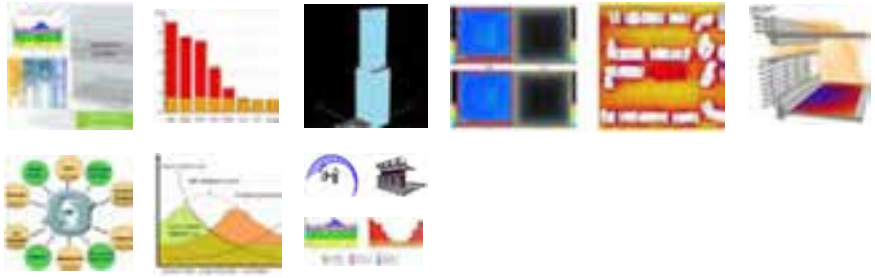
Energy Performance and Analysis

Dong-Hwan Ko, PhD

Illinois Institute of Technology
Professors: Raymond J. Clark, Varkie Thomas & Mahjoub Elnimeiri



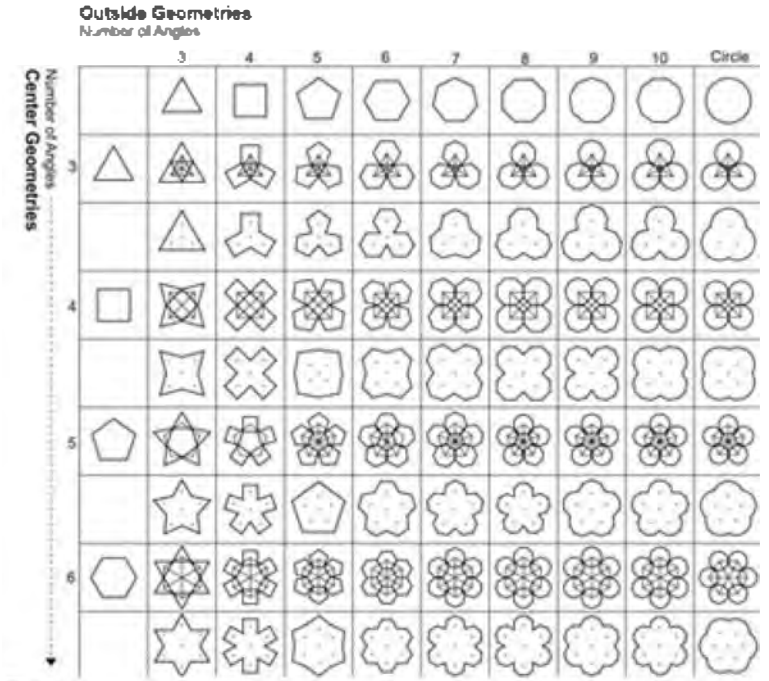
Thesis research



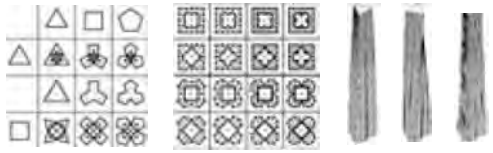
Tall Building Form Generation

Sang Min Park., PIID

Illinois Institute of Technology
Professors: Robert J. Krawczyk and Mahjoub Elnimeiri



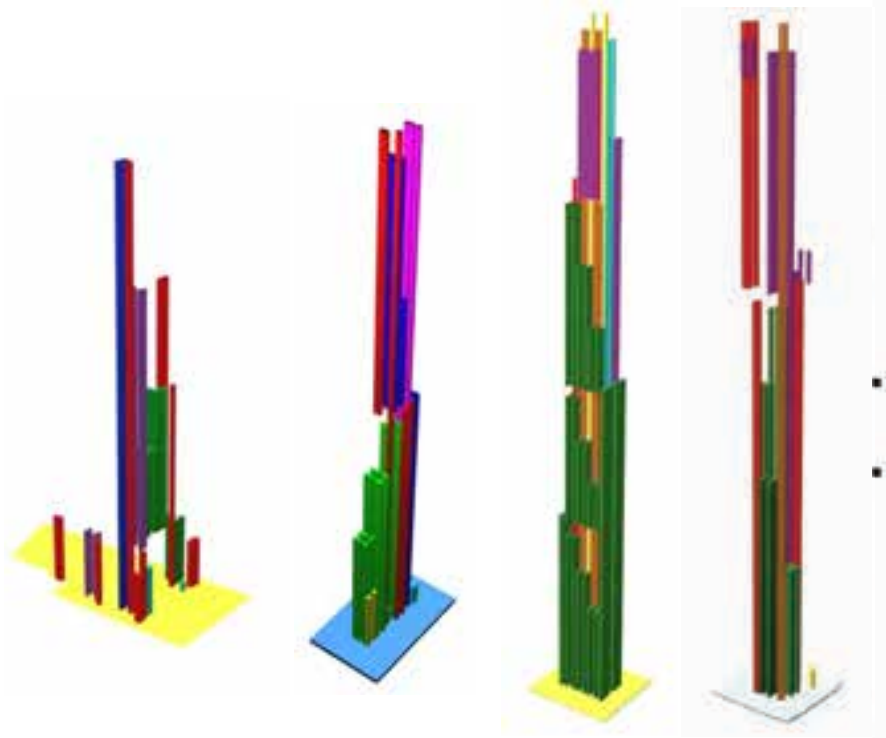
Thesis research



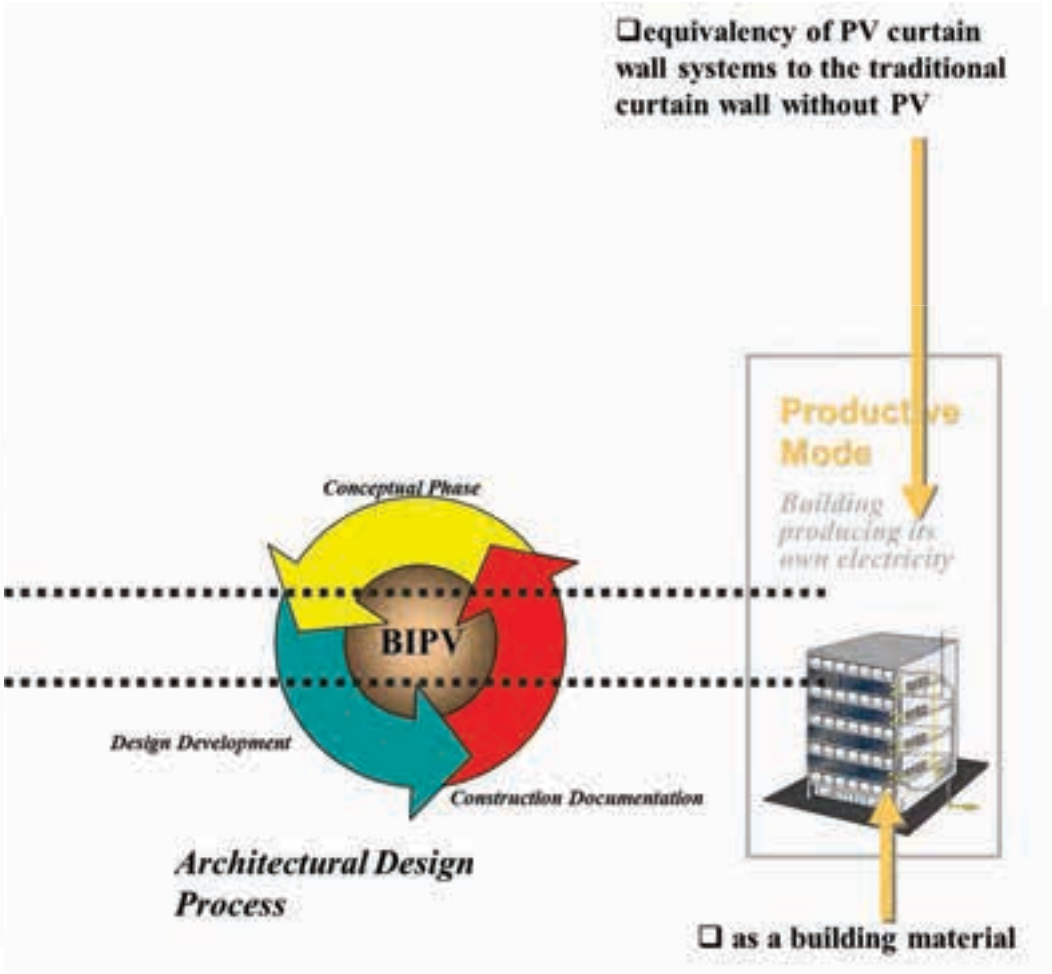
Space Efficiency in Mixed-Use High-Rise Building

Dr. Hyeong-ill Kim,

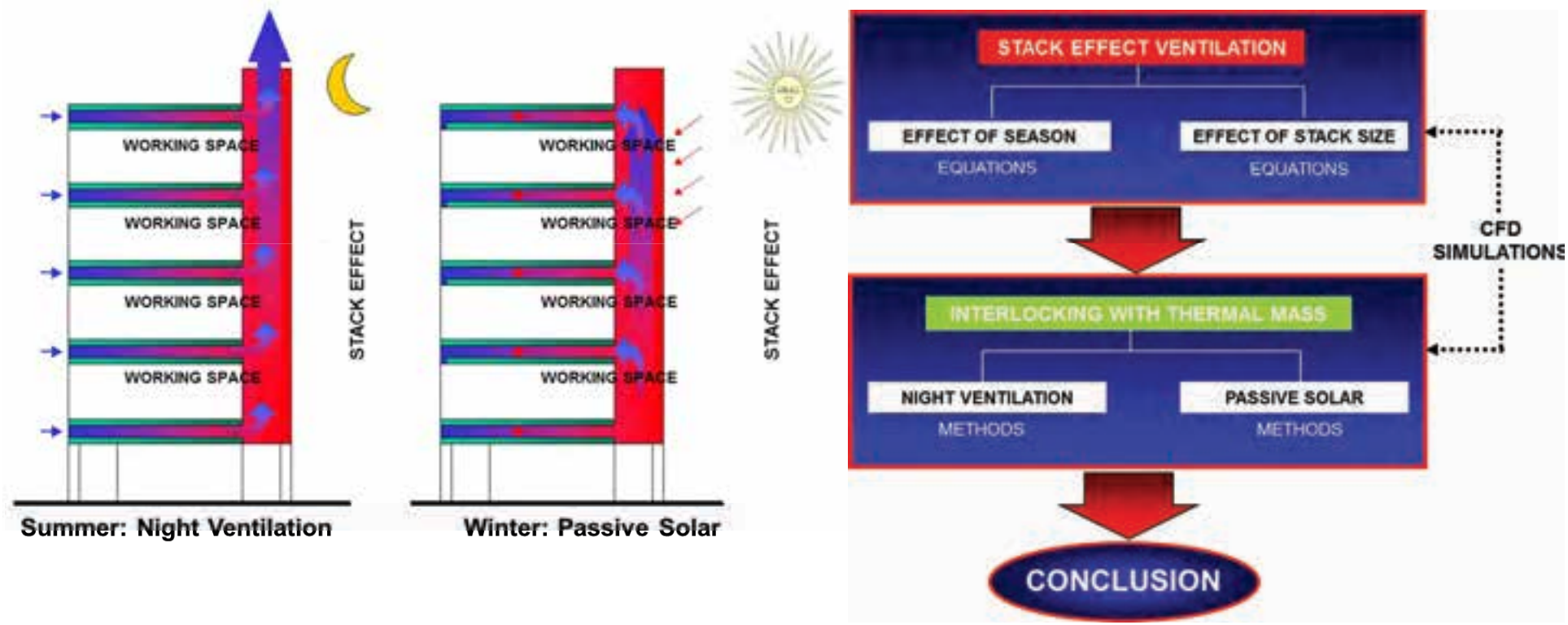
Determine the relationships of parameters in related with space efficiency in multi-use building



Identification of the barriers to the BIPV design process as applied to curtain wall



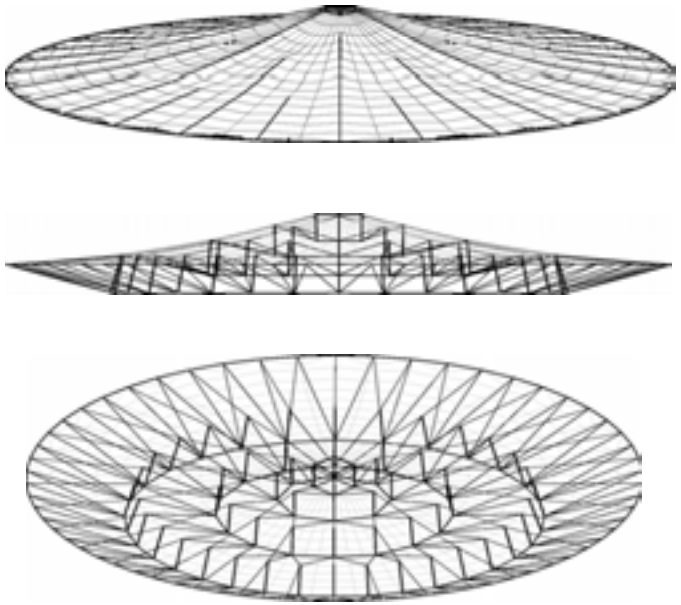
A Parametric Study of the Interlocking of Stack Effect Ventilation with Building Thermal Mass in Commercial Building

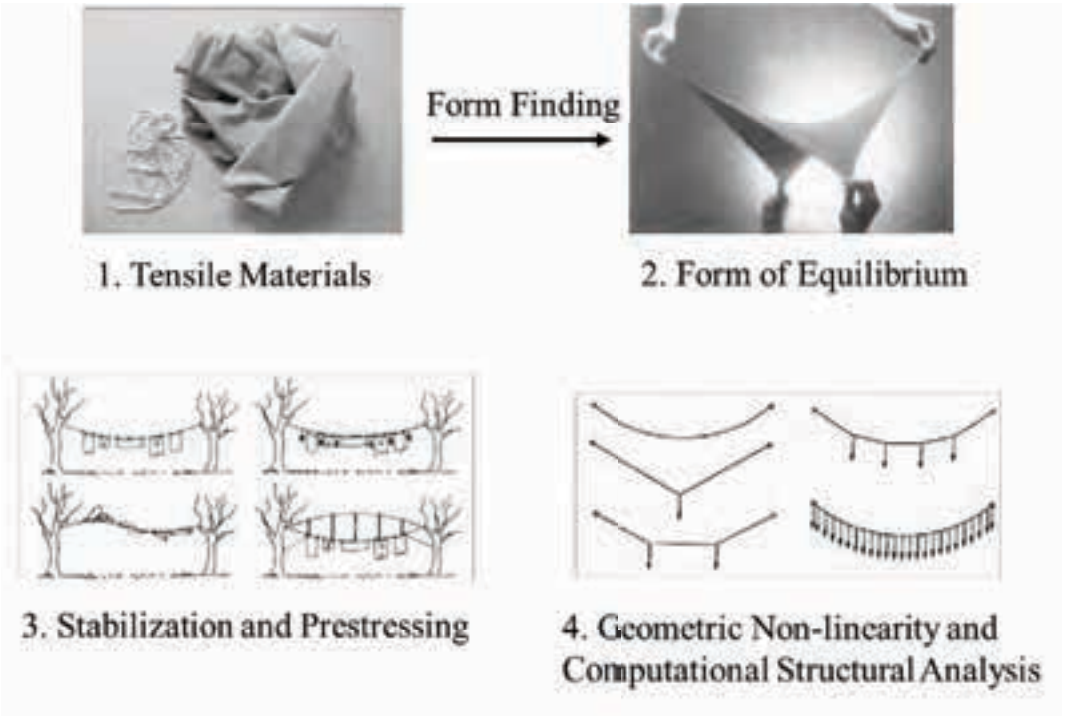


Development of Form Finding of Tensile Structures: Architectural Approach

Hiroki Tamai, PhD

Professor Mahjoub Elnimeiri





Development of Form Finding of Tensile Structures: Architectural Approach

Hiroki Tamai, PhD
Professor Mahjoub Elnimeiri

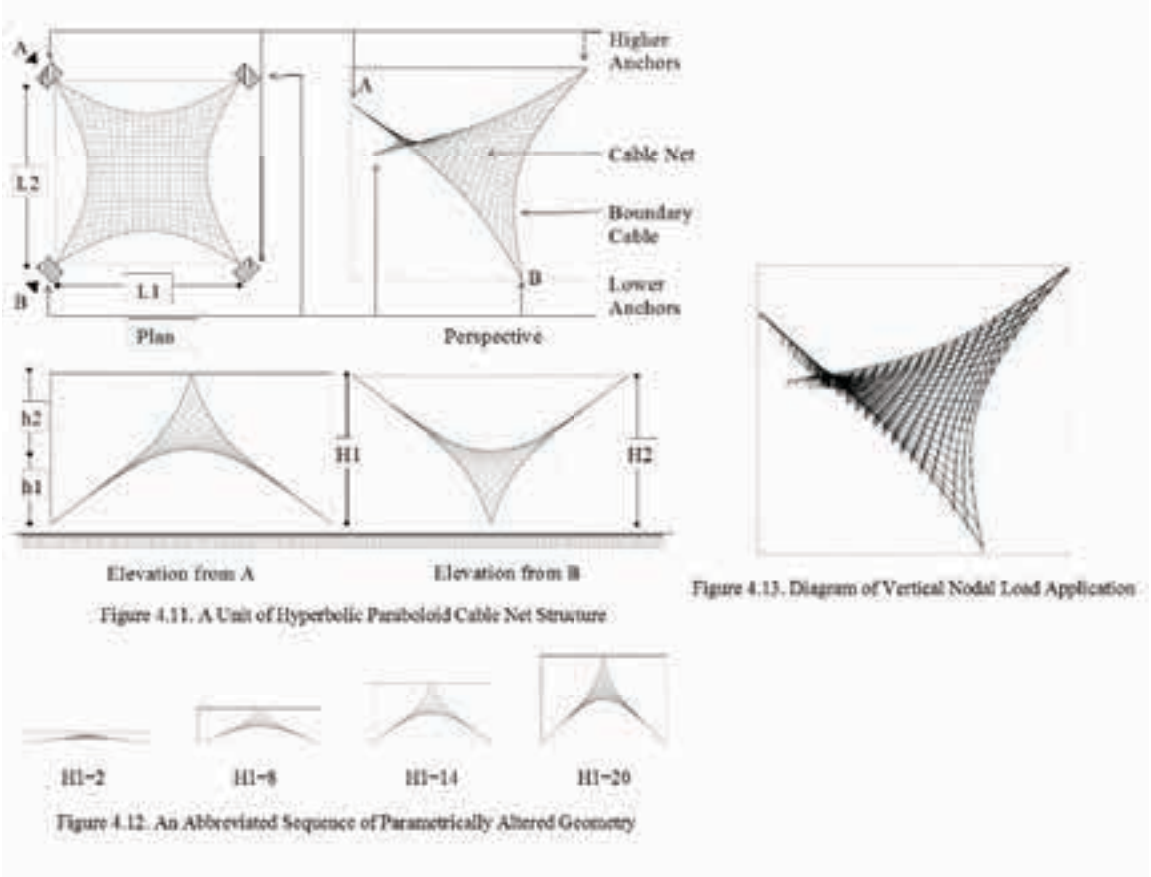
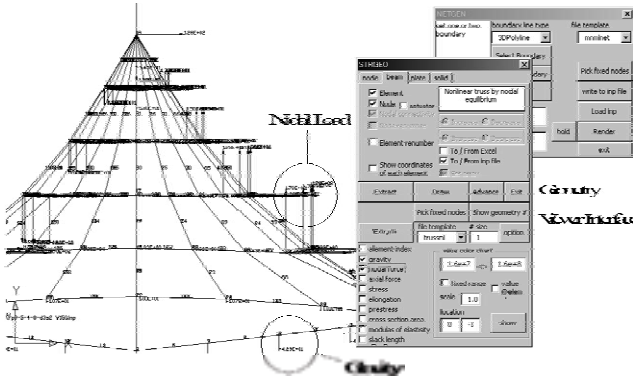
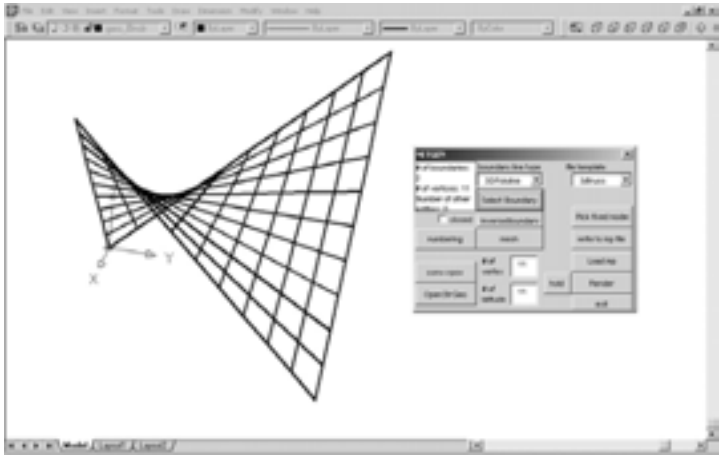


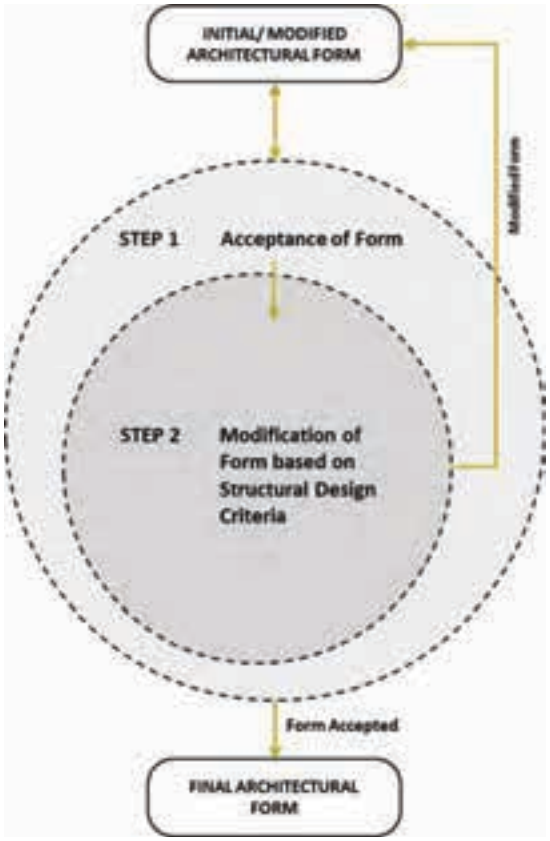
Figure 4.11. A Unit of Hyperbolic Paraboloid Cable Net Structure

Figure 4.12. An Abbreviated Sequence of Parametrically Altered Geometry

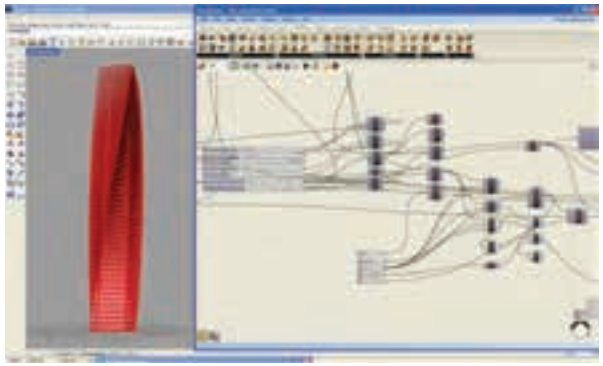
Figure 4.13. Diagram of Vertical Nodal Load Application

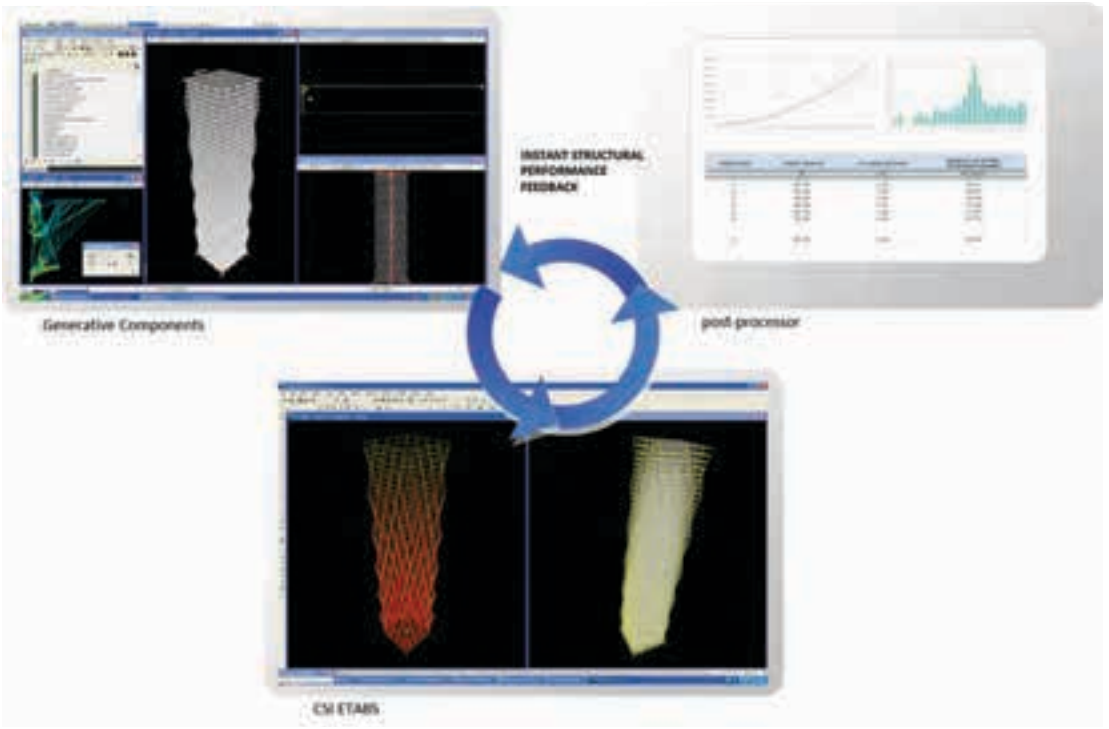






PROPOSED PROCESS





Facts & Motivations (Problem Description)

Part (3) Material Selection

(A) Material Selection Strategies

(B) Material Selection Process

Stage (1) Performance Criteria

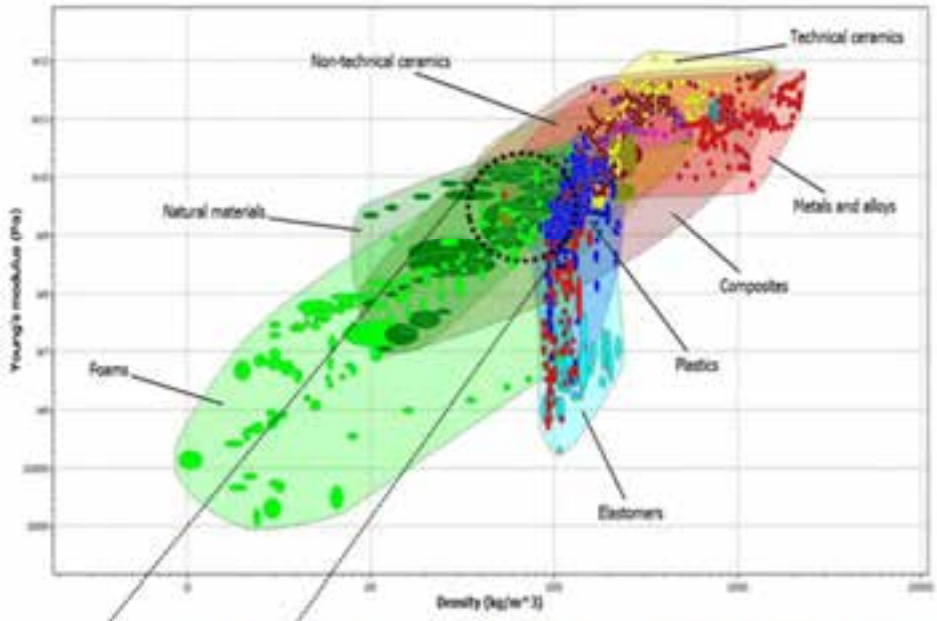
(B) Material Selection Process

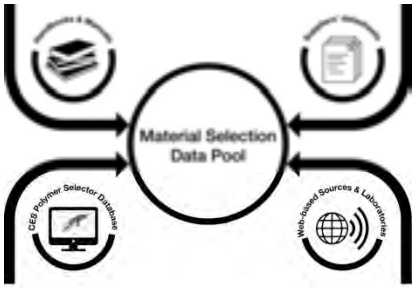
THE BIOENCLOS© FAÇADE PANEL

FROM SELECTION TO DESIGN, ASSESSMENT AND BEYOND

Ahmed Ali Hassan, PhD,
Professor Mahjoub Elnimeiri

The major
concerned
& Organiz





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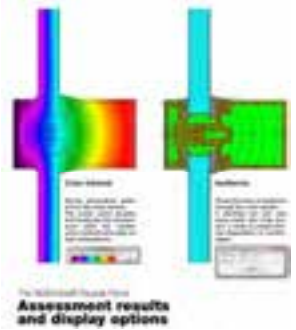


Chemical Engineer

Architect

Ahmed Ali Hassan, PhD, IIT, 2016

Structural Engineer

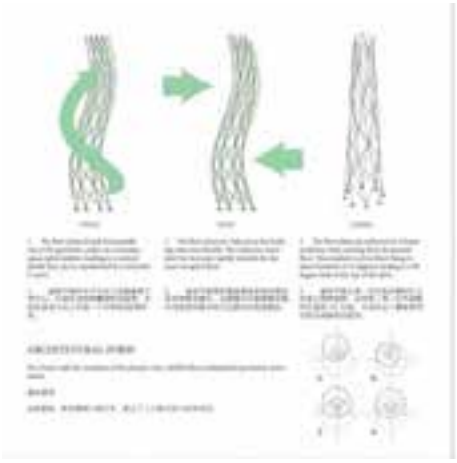
Mechanical Engineer

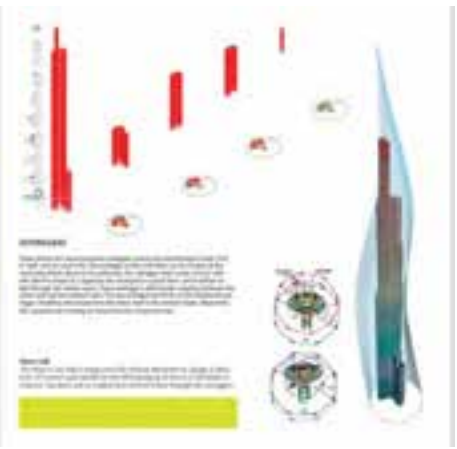
Wind Tunnel Testing
HYU Seoul, Korea 2010

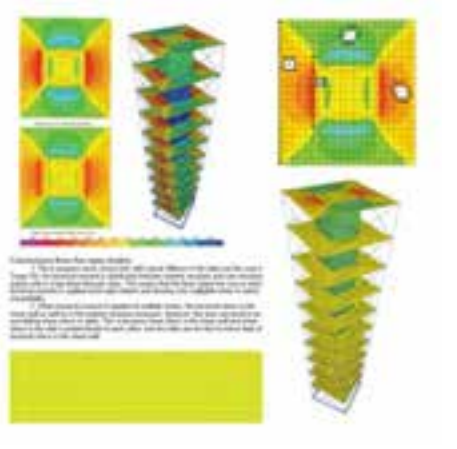
Video Conference Lectures
2006 to present

Currently writing 2 books:

1) **Visual approach of Structure (Text book)**
2) **Structure and Form of Tall buildings.**







Dr. Mahjoub Elnimeiri, President

“We capitalize on our ability to think the problem through from its inception to its realization."

eeciplus -engineers International
112'3 N Wafer St, Suite 302
Mi1lwaukee, WI, 53202

www.eeciplus.com
Info@eeciplus.com

eeciplus

ELNIMEIRI ENGINEERS CONSORTIUM INTERNATIONAL

Dubai Sport Counsel Stadium

Location : Jumairah, Dubai, UAE
Year : 2013
Architect : Zaha Hadid Architects
Scope : Structural Design

MRM Residential
MINA RASHID
Dubai UAE. 2016 to present
Architect: Alliance Architecture

MRM Residential

eecplus

Kamel Family Tower Complex

Jeddah, Kingdom of Saudi Arabia

2013 to present

Architect: Tvs design, Atla ta, GA

CBE Tower
2011-2012 Addis Ababa, Ethiopia

Design Built joint venture
Design & Architecture bureau (DAR)
GC: ASCON
A 48 story office tower in the heart of Addis Ababa

Relevant Experience

CBE Tower

Tower 29
Dubai UAE. 2007
Architect: Tvs design, Atlanta GA

Tower 29

Relevant Experience

eecplus

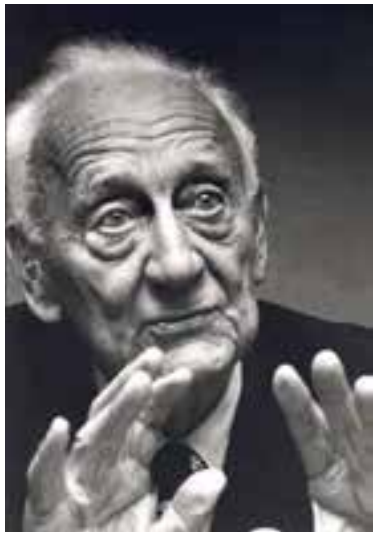
Dr. Mahjoub M. Elnimeiri
Professor and Founder of PhD in Architecture Program College of Architecture, Illinois Institute of Technology, Tel: + 1 312 567 3990 Fax: +13125676816
Email:elnimeiri@iit.edu

ARCHITECTURAL RESEARCH AND THE BUILT ENVIRONMENT

IIT - COLLEGE OF ARCHITECTURE - PROFESSOR MAHJOUB ELNIMEIRI - PhD / DIRECTOR PhD PROGRAM / 1997 - 2012

WHAT IS RESEARCH ?

DEFINED BY SCIENTISTS, PHILOSOPHERS, AND A PLAYWRIGHTER

Creating new knowledge. - *Neil Armstrong*

To see what everybody else has seen, and to think what nobody else has thought. - *Albert Szent-Gyorgyi*

Under normal conditions the research scientist is not an innovator but a solver of puzzles, and the puzzles upon which he concentrates are just those which he believes can be both stated and solved within the existing scientific tradition. - *Thomas Kuhn*

Four things: brains with which to think, eyes with which to see, machines with which to measure and, fourth, money. - *Albert Szent-Gyorgyi*

Copy from one, it's plagiarism; copy from two, it's research. - *Wilson Mizner*

WHAT IS THE PhD PROGRAM:

COLLEGE OF ARCHITECTURE - ILLINOIS INSTITUTE OF TECHNOLOGY, CHICAGO, IL.

Research based:

with emphasis in application rather than theory …

Technology based:

with emphasis in collaboration and team work …

WHY PhD PROGRAM AT IIT:

COLLEGE OF ARCHITECTURE - ILLINOIS INSTITUTE OF TECHNOLOGY, CHICAGO

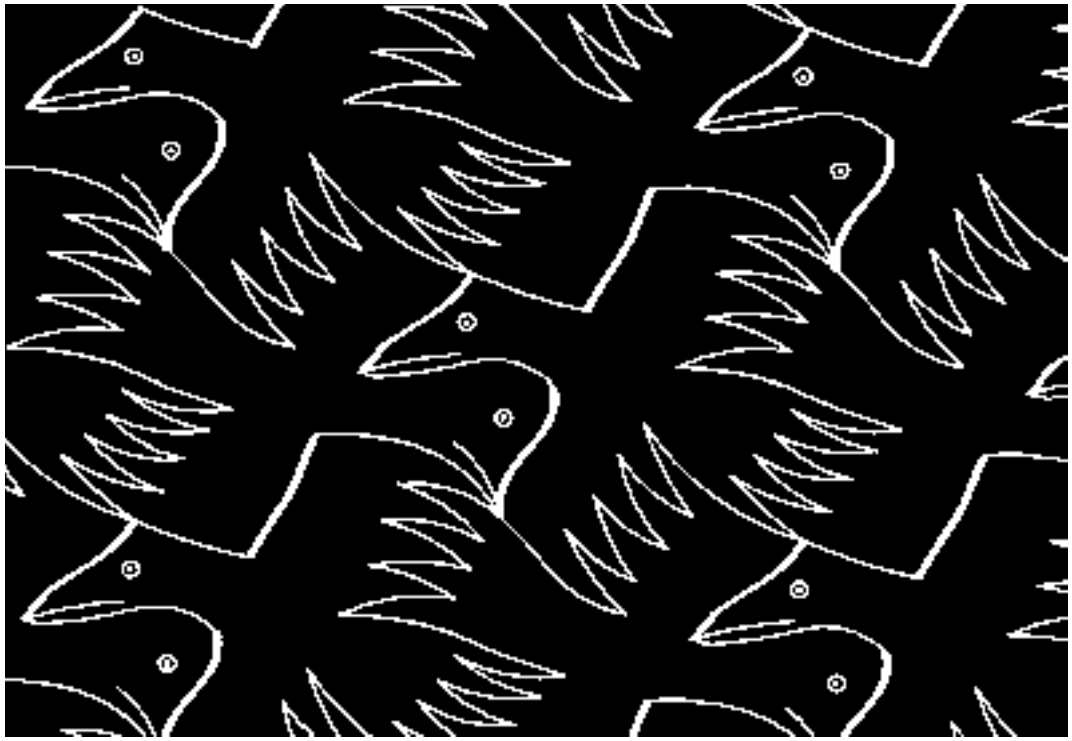
Tradition and history of the college

Chicago and its resources

Integration between academia and practice

WHAT IS COLLABORATIVE WORK ?

“If I have seen further than others, it is by standing upon the shoulders of giants.” Issac Newton

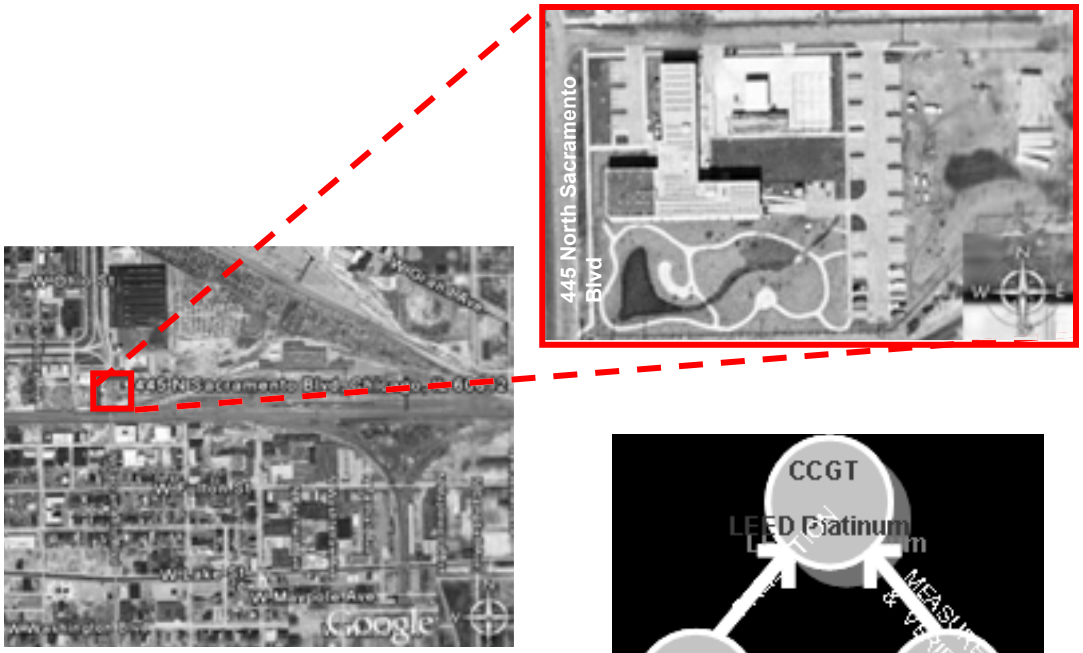


Emphasizing close interaction with:

- ***Practice …***
- ***Other academic disciplines …***
- ***Professional community …***

CCGT MEASUREMENT & VERIFICATION STUDY:

Department of Environment – 445 North Sacramento Boulevard, Chicago, IL, U.S.A.



Location: 445 North Sacramento Blvd, Chicago, IL
Owner: Chicago Department of Environment
Designed by: Farr Associates Architecture and Urban Design **Type**: 2-story Commercial Office, Industrial, Assembly, Other **Area**: 40,000 sq.ft. (3,720m²)
Rating: U.S. Green Building Council LEED-NC, v1.0-Level: Platinum

CCGT & PLATINUM LEED CERTIFICATION: :

DESIGNED BY USING THE HIGHEST STANDARDS OF GREEN TECHNOLOGY

- Solar Power: Solar Panels
- Daylight Control
- Rain Water Collection for Irrigation: Cisterns
- Recycled Building Material
- Smart Lighting
- Green Roof
- Geothermal Exchange System

Smart Lighting

Cisterns

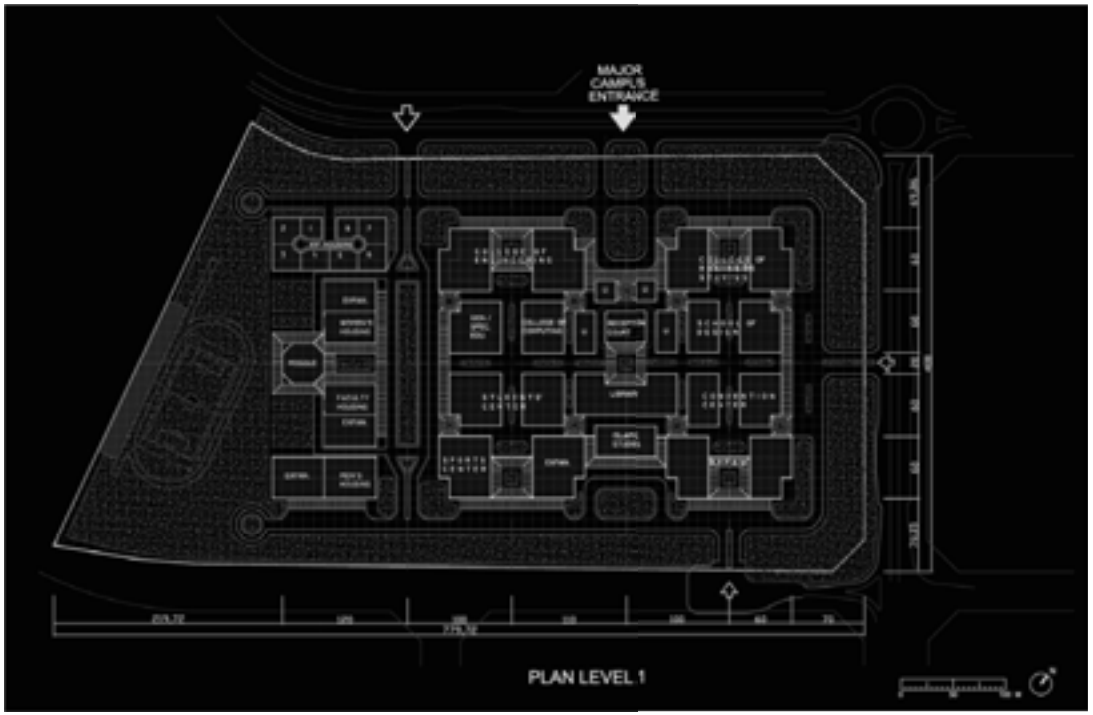
Green Roof

Solar Panels

Ground Pumps

AL-GHURAIR UNIVERSITY- CAMPUS PROJECT :

SHEIKH ZAYED ROAD, DUBAI – UNITED ARAB EMIRATS – AL GHURAIR GROUP NON-PROFIT INSTITUTION



PhD PROGRAM - STUDENTS RESEARCH WORK EXAMPLES:

BRASIL, CHINA, EGYPT, HUNGARY, INDIA, IRAN, JORDAN, KUWAIT, NIGERIA, MEXICO, SAUDI ARABIA, S.OUTH KOREA, SUDAN, TAIWAN, THAILAND, TURKEY, U.S.A., VIETNAM












What do you look for in PhD?

- To be an expert in a specialized research field?
- To be more knowledgeable in cutting edge technology or design approach?
- To be a teacher/architect/engineer with new visions?

What is expected in a PhD degree?

- Teaching and research ability in your major discipline
- Ability to tackle any general problem
- Insight to understand and apply cutting edge ideas, concepts, technologies, science in your field
- Interdisciplinary research skill

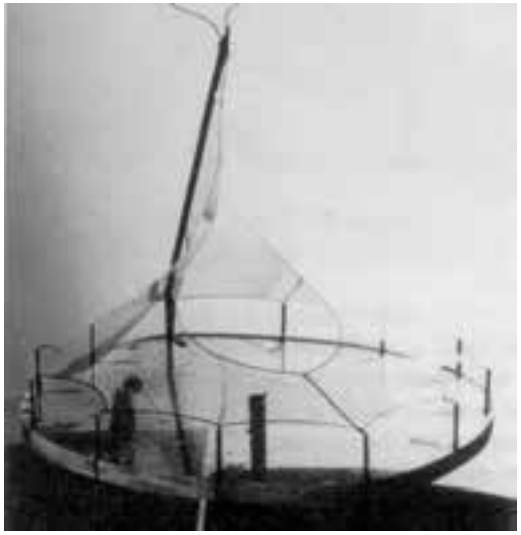
What is your value in practice?

- Expertise
- Insights
- New visions
- Capability to carry out those above
- Ability to challenge to building codes based on scientific knowledge, new technology or new reported researches

FORM FINDING OF TENSILE STRUCTURES:

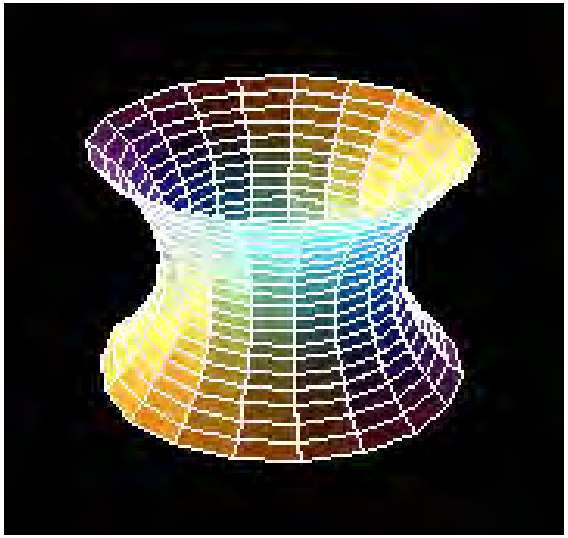
HIROKI TAMAI - PhD – COLLEGE OF ARCHITECTURE – ILLINOIS INSTITUTE OF TECHNOLOGY – ADVISOR: MAHJOUB ELNIMEIRI

Physical Model Approach



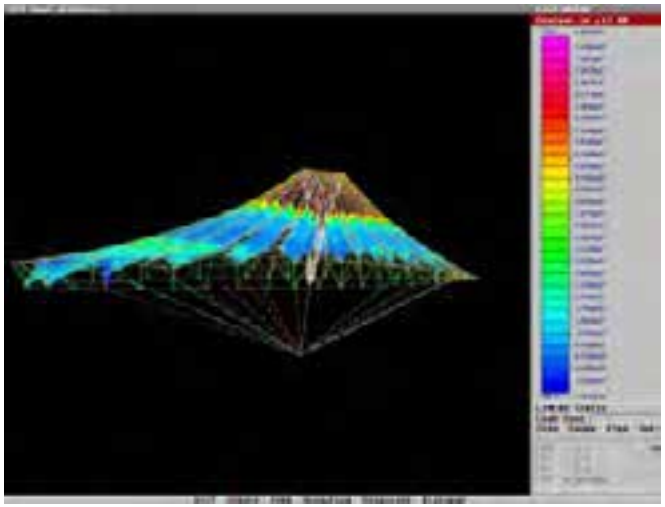
1967

Theoretical Approach



1974

Computational Approach



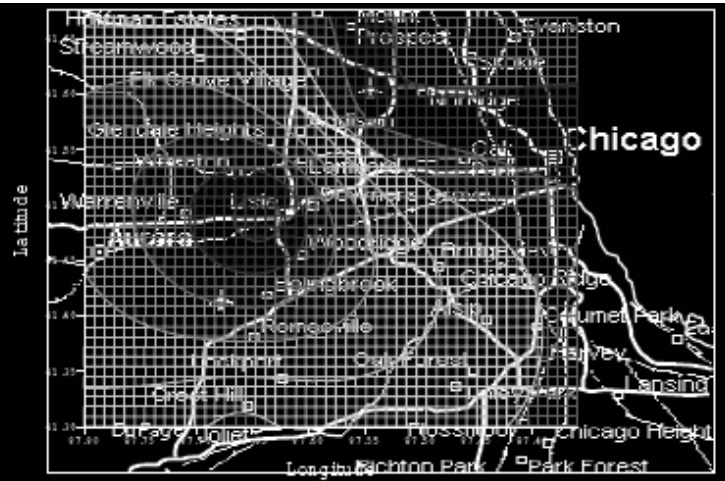
2000

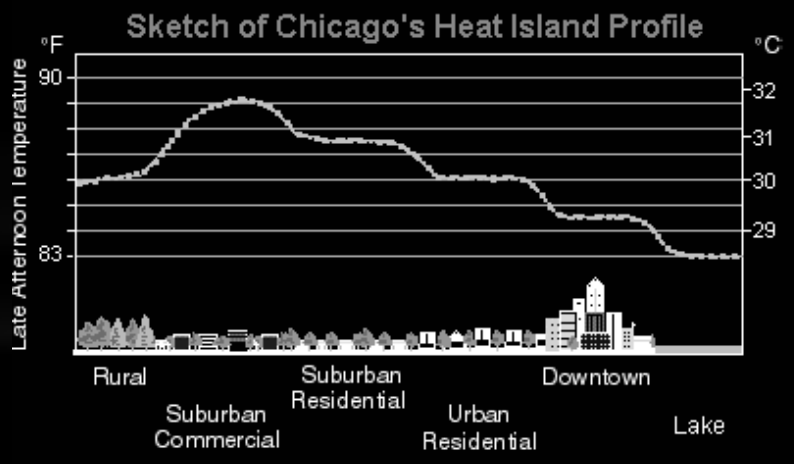
URBAN HEAT ISLAND EFFECT, URBAN MORPHOLOGY & BUILDING ENERGY

PRAVIN BHIWAPURKAR – COLLEGE OF ARCHITECTURE – ILLINOIS INSTITUTE OF TECHNOLOGY, CHICAGO, IL., USA – ADVISORS: PETER LAND & RAY CLARK – FALL 2007

This study integrates urban climate, urban design and building energy needs to minimize negative effects of climate change.

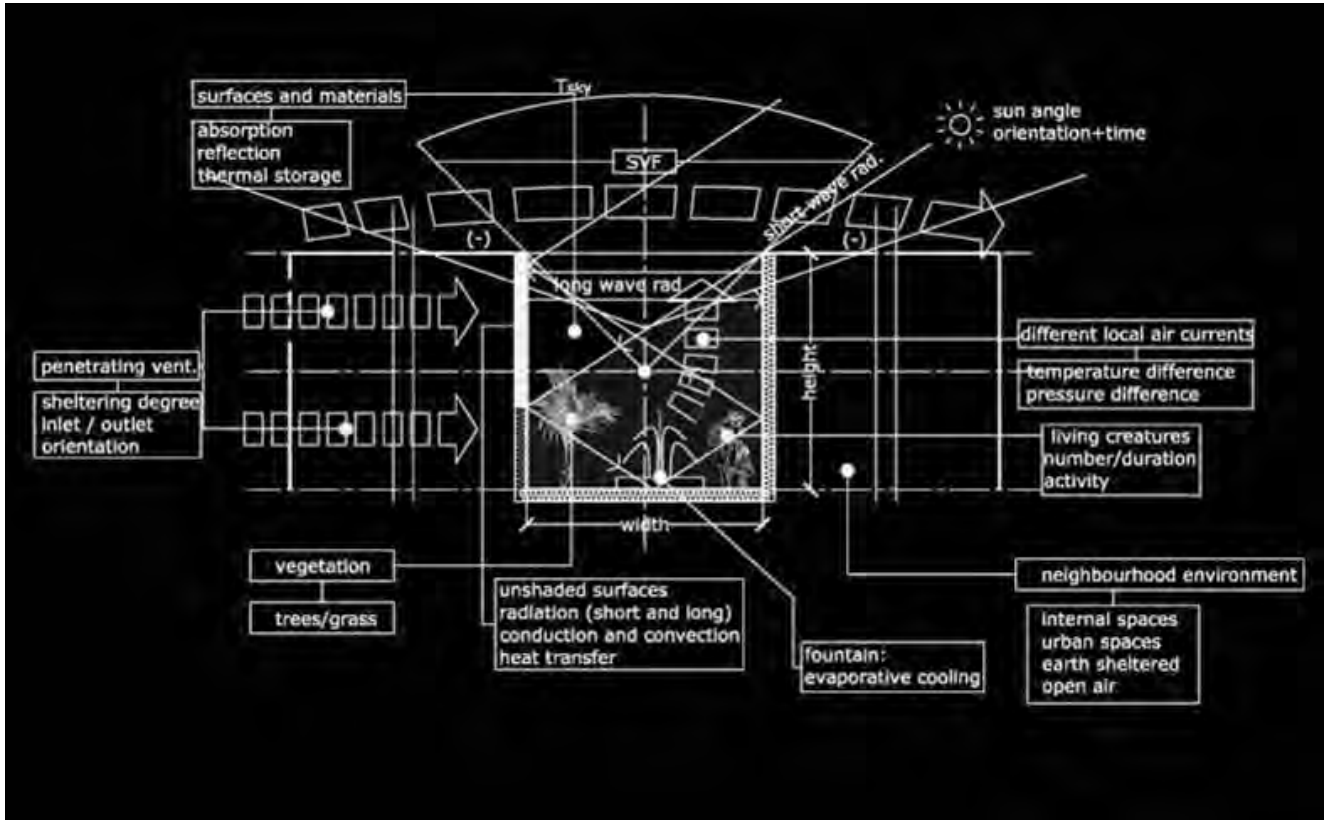
The urban heat island intensity for urban climate change and role of street geometry as urban design parameter was considered in the study. The changes in climatic element are studied for change in building energy. The sensitivity analysis of street aspect ratio and orientation is performed to investigate the changes in building energy needs.

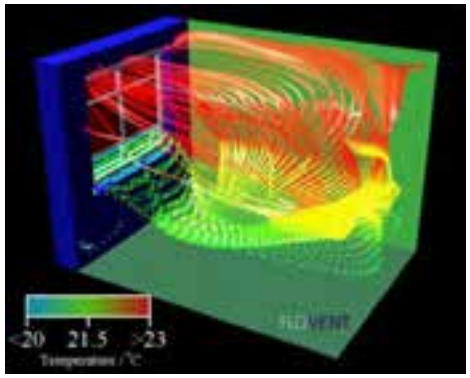


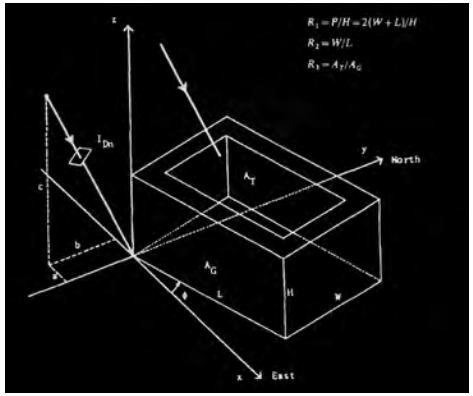


STUDIES ON THE GEOMETRICAL PROPERTIES OF COURTYARD HOUSE FORM

CONSIDERING NATURAL VENTILATION IN HOT- DRY REGIONS - TALLAL A SAEED – PhD CANDIDATE – IIT - ADVISORS – PROF. MAHJOUB ELNIMEIRI + R. CLARK - MARCH 2007



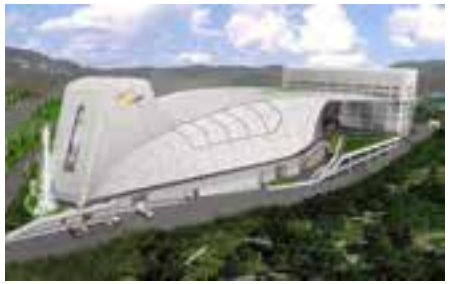


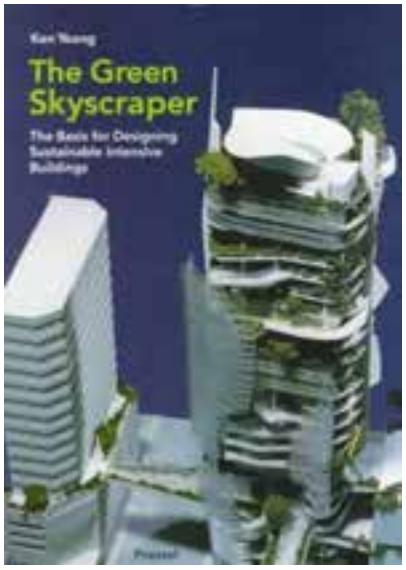


This study investigates the thermal effects of the courtyard geometry. The study provides a new look to the research on this area by considering different ventilation scenarios in hot dry areas. The study also questions the basis of thermal performance evaluation for traditional housing types.

KEN YEANG / ARCHITECT + PhD:

DOCTORATE IN ECOLOGICAL DESIGN FROM CAMBRIDGE UNIVERSITY, U.K.





RESEARCH & BUILT ENVIRONMENT:

PAST, PRESENT AND FUTURE PROBLEMS AND OPPORTUNITIES