GIT Summer Workshop 2019

Building Information Modeling Part

Course overview:

Building Information Modeling (BIM) is transformational way of designing, construction, and operating buildings and infrastructure by providing digital representations and their development process over the project lifecycle. BIM-applied technologies and process affect contracting, architectural design, fabrication, construction, and facility operation and maintenance. BIM application also provides new opportunities for innovation both in design, in research and practices in the construction industry.

The class will introduce for students to apply BIM in the construction project life cycle, including modeling, model coordination, site management, schedule monitoring, constructability management, and energy analysis. This course will address a selection of critical BIM-oriented technologies and practices enabled by BIM, and some of the new challenges it introduces.

The learning environment of the class is shaped through various interactive teaching techniques, such as class discussions, case studies, site visit, and computer lab. Students will deal with coordination, collaboration, and simulation of construction process through hands-on computer lab in this class.

Learning objectives:

After the completion of this course students will be able to:

- Develop BIM skills for 3D/4D modeling, quantity takeoff and scheduling, site management, and energy simulation with Revit and Navisworks Manage
- Define BIM, its technology and process
- Understand key concepts of BIM and related technologies & process
- Describe the applications of BIM throughout the entire phases of a project life cycle
- Analyze potential impacts and values of BIM on traditional processes
- Identify the benefits and challenges of BIM implementation
- Discuss BIM implementation strategies, and industry standard contracts
- Forecast potential future trends associated with the advent of BIM-enabled design, fabrication, construction, and operation of buildings

BIM 被認為是建築產業的重大變革，通過參數化和可視化的特性，BIM 影響工程項目全生命週期過程，從設計、施工到設備營運和維護。同時 BIM 在專案中的應用刺激了工程領域的創新發展。此 workshop 介紹 BIM 在工程全生命週期的運用，包含設計建模、多專業工程協調、施工管理和設備營運維護。

指導學生掌握相關技術，同時瞭解 BIM 如何整合到工程專案現有流程及其在運用過程中存在的困難。整個 workshop 採用互動性教學方式，形式包含課堂討論、案例分析、工程專案參觀與實際操作等。學生在過程中學習如何通過電腦模擬瞭解工程專案執行的完整過程。

學習目標:

- 掌握使用 revit 和 navisworks 等軟體 3D/4D 建模、工程量計算、進度控制、施工場地管理與能源模擬等。
- 理解 BIM 的內涵、相關技術和流程。
- 瞭解 BIM 在建築全生命週期的應用。
- 理解 BIM 跟工程相關傳統流程之間的關係、潛在影響和價值
- 理解 BIM 應用過程中存在的困難和挑戰
- 瞭解 BIM 的未來發展方向

Instructor Information

Dr. Daniel Castro-Lacouture

Daniel Castro-Lacouture is Professor and Chair in the School of Building Construction at Georgia Institute of Technology. His current research centers on defining and implementing performance evaluation protocols for technology innovation in the built environment, such as sustainable construction materials and alternative sources of energy. He received a BSc in Civil Engineering from Universidad de Los Andes, Colombia, an MSc in Construction Management from The University of Reading, UK, and a PhD in Construction Engineering and Management from Purdue University. He is a member of the International Green Builder Certification Board and the ACE Mentor Program of Atlanta Governing Board, a Registered Professional Engineer, Associate Editor of Automation in Construction, and was Chair of the 2014 ASCE Construction Research Congress. Castro-Lacouture has been co-recipient of the best paper award at two international conferences, and has worked in project management in the public and private sectors

Yuqing Hu

Yuqing Hu is a Ph.D. candidate and a research/teaching assistant in the School of Building Construction at Georgia Institute of Technology. Her doctoral research investigates the use of artificial intelligence combined with building information modeling to improve the design coordination process. She implements heuristic algorithms and machine learning method to clean out irrelevant clashes and design clash correction strategies for providing global optimized solutions. She published the paper “Clash Relevance Prediction Based on Machine Learning” that using historical data to automatically distinguish important clashes from clash reports. She earned her master’s degree in construction management from Tongji University in China. During graduate study, she conducted research pertaining to Building Information Modeling (BIM), including “Organization optimization for BIM-enabled construction project”, funded by funded by National Natural Science Foundation of China, and “The trial implementation of BIM-based permitting”, funded by Shanghai government.

GIT Summer Workshop 2019

Shape Grammar Part

Tzu-Chieh Kurt Hong

ME, MS, MArch, PhD candidate

Shape Computation Lab

School of Architecture

College of Design

Georgia Tech

Program overview

What does it mean to have a new modeling software for design that allows designers to specify their actions by drawing shapes rather than by writing scripts? What is the difference between an object registered in your computer system and a shape you really see? What does it mean to program with shapes?

For nearly four decades, the shape grammar discourse has described a different paradigm of design computing with the promise of revolutionizing computer-aided design (CAD). Its foregrounding of visual rules (shape rules drawn in a 2D or 3D modeling system) over symbolic rules (instructions defined in some programming language) has provided a robust theory for designers to believe in but nevertheless a formidable challenge to implement.

This workshop will introduce the Shape Machine, a new visual programming software developed at the Shape Computation Lab at the School of Architecture, College of Design, in collaboration with the Schools of Mathematics and Interactive Computing at the Colleges of Science and Computing at Georgia Institute of Technology. In this workshop, students will learn to automate your routine drafting functions and address engineering issues by drawing shape rules instead of writing code and reworking shape rules instead of debugging code.

Learning Objectives:

- Understanding the concept of shape computation and shape grammar
- Visually defining the problems in architecture and building construction
- Understanding the issues and the limitations in current CAD systems
- Discovering the possibilities of shape computation in any discourse
- Being able to use Shape Machine to construct shape rules
- Being able to program with shapes in DrawScript
- Visually addressing issues in architecture and building construction

如果我們擁有一個軟體，這個軟體能夠辨視並理解你所畫的形狀、圖示或是幾何，並且執行你所要求的修改或是任何設計指令，而在這整個過程中我們都不需要寫任何的程式語言，不需要碰觸到任何的資料結構，不需要鑽進一堆程式碼的茫茫大海之中，這樣的軟體，會對我們的專業帶來什麼變化呢? 在過去的幾十年來，形狀文法(Shape Grammar)一直不斷地強調我們現今所使用的電腦輔助軟體(CAD, Computer-aided Design)必須被從根本上改變，因為這些現有的軟體與我們的視覺系統有著非常大的差異，而這個差異卻大大地限制住我們所能做的事。形狀文法強調，我們應該藉由視覺的形狀規則(shape rules)來進行設計運算，而非使用資料、數字或是符號。因為資料、數字與符號並非我們在設計過程中真正所看見的，資料、數字與符號只是為了配合電腦而使用的。形狀文法在這四十年的發展以來，許多研究單位包含麻省理工學院(MIT)、卡內基美崙大學(CMU)以及瑞士聯邦理工學院(ETH)都不斷地試圖將這個概念實現在現今的電腦架構上，但都失敗了。然而，在 2018 年的喬治亞理工學院(Georgia Tech)，由 Dr. Thanos Economou 所帶領的形狀運算實驗室終於完成了第一代的形狀機(Shape Machine)，解決了四十年來無人可解的難題，並且將形狀機逐步地使用在各個領域中。在這個工作坊中，學生們會學習形狀文法的基礎並且學習如何使用形狀機，進而學會如何使用形狀規則來解決建築設計與建造中的各種難題。

Instructor Information

Professor of Architecture

Athanassios (Thanos) Economou is Professor in the College of Design at the Georgia Institute of Technology. Dr. Economou's teaching and research are in the areas of shape grammars, computational design, computer-aided design and design theory, with over forty published papers in these areas. Recent funded projects include the Shape Machine sponsored by NSF/iCorps and the project Courtsweb: A Visual Database of Federal Courthouses, GSA/US.Courts, $1.3M. Design projects from his studios at Georgia Tech have received prestigious awards in international and national architectural competitions. He is the Director of the Shape Computation Lab at Georgia Tech and the Director of the Architetconics in Greece and Italy Study Abroad Program at Georgia Tech. He has been invited to give talks, seminars, and workshops at several universities including MIT, Harvard, TU Vienna, U. Michigan, Tsinghua U, UCLA, NTUA, U.Thessaly, U.Aegean, among others. Dr. Economou holds a Diploma in Architecture from NTUA, Athens, Greece, an M.Arch from USC, and a Ph.D. in Architecture from UCLA.

ME, MS, MArch, PhD Candidate

Tzu-Chieh Kurt Hong is a PhD candidate in the School of Architecture at the Georgia Institute of Technology. The current research of Kurt is mainly focusing on implementation of shape computation system, including the development of geometry/graph kernel, novel data representations and shape recognition algorithms. Kurt is a research assistant at the Shape Computation Lab working with Dr. Thanos Economou and his works include the implementation of shape grammar interpreter, generative modeling system of US Courthouse design and generative modeling system of Froebel blocks. Before entering Shape Computation Lab, Kurt was a research assistant at the Digital Building Lab working with Dr. Dennis Shelden, and his main contribution to Digital Building Lab included the implementation of Automatic Routing System in architecture and an interactive web-based data visualization platform, Smart 3D Atlanta. Kurt holds BSEE, MSEE, MArch from the National Chiao Tung University (Taiwan), and MSArch from the University of Michigan.