

Subject Number(s)

4.507/4.567

Subject Title and Subtitle

Introduction to Building Information Modeling in Architecture

Term offered

Spring 2024

Instructor(s)

Takehiko Nagkaura

In collaboration with Timo Riekko (Alvar Aalto Foundation, Helsinki)

TA(s)

Xiaoyun Zhang

Credit Units

3-2-7 U/G or 3-2-4 G

Level

U: 4.507; G: 4.567

Prerequisites

None

Schedule

Lecture/Review	Thursday, 9:00am-10:30am (1-132)
Demo/Lab/workshop	Thursday, 10:30am-Noon (1-132)

Subject Description

This course addresses fundamental methods, theories, and practices that engage contemporary modeling tools in the context of architectural design. It introduces selected academic and professional topics through lectures, demonstrations, and assignments. Topics include component types and assembly, parametric modeling, visualization, simulations, and scripting. Students are expected to initiate intellectual explorations through the use of Building Information Modeling software (Revit) for architectural design projects, and to develop foundations to apply it to their own research projects and design practices later.

For Spring 2022 class, Alva Aalto's design projects are used for analysis. For modeling and simulation, archival resource (drawings and photos) is provided by Aalto Foundation in Helsinki, and outcome of some student projects may be included in their upcoming exhibition in Europe.

List of Subject Objectives

- Ability to represent an architectural project through BIM software
- Analyze an architectural design through making a BIM model
- Learn the theoretical background of BIM software
- Learn research opportunities in application or development of BIM software

Evaluation Criteria

Final grade is based on 2 projects and attendance (i.e., class participation). The progress of each project will be reviewed at a constant pace during the regular classes. The class ends with a final review (project 1+2) during the last class, and there is no exam during the exam period. The weight of each portion for grading (9 unit option/12 unit option) is below.

Project 1: Modeling/Simulation (50%/45%)

Project 2: Parametric Design and Advanced Visualization (40%/45%)

Attendance (10%)

* Dynamo application is a topic covered at the end of the semester. Students who applies for 9 unit option are not asked to include Dynamo exercise in the Project 2.

* Each project is evaluated in terms of completion, timeliness, and quality of presentation.

Schedule of Exercises, Projects, Quizzes, Exams or Assignments

class 01 Thursday 2024.02.08	Introduction History: BIM vs. Geometric Modeling	Project 01 out : Design Analysis/Simulation Demo: Revit Basic Interface, View/Projection, Grid and Levels Lab: working session
class 02 Thursday 2024.02.15	Ontology of Architectural Types <i>Progress check:</i> Resource compilation	Demo: Pre-defined Parametric Types, Constraint Propagation Lab: working session
class 03 Thursday 2024.02.22	Projection and Perspective <i>Progress check:</i> Design Documents	Demo: Transformation, Group/Link, Area/Rm, Sheet/Schedule Lab: working session
class 04 Thursday 2024.02.29	Image Processing, Visualization <i>Progress check:</i> BIM model	Demo: Raytracer, Day-lighting, Photometric Light (IES) Lab: working session
class 05 Thursday 2024.03.07	Integrated System Visual Representations	Demo: Material, Walk-through, Topography Lab: STL/DWG conversion (for 3D printing)
class 06 Thursday 2024.03.14	Analysis and Simulations Construction, Energy, and Structural	Demo: Green Building Studio, Robot, Navisworks Lab: working session
class 07 Thursday 2024.03.21	<i>Presentation: Project 01</i>	
Thursday 2024.03.28	Spring Vacation (3.25-3.29) -----	-----
class 08 Thursday 2024.04.04	Revisiting Parametric Types in BIM	Project 02 out : Adaptive Design (Generative/Parametric) Demo: Custom Types (Family), Progressive Modeling
class 09 Thursday 2024.04.11	Subdivisions and Parametric Types	Demo and Lab: Adaptive Component Typology BIM (Nagakura and Sung)
class 10 Thursday 2024.04.18	AR/VR and BIM Design and Globalization	Demo: AR/VR/Unity 3D
class 11 Thursday 2024.04.25	Visual Programming	Demo and Lab: Dynamo, Revit API/SDK

class 12
Thursday
2024.05.02 Coding Process and Knowledge Demo and Lab: Dynamo, Revit API/SDK
Guest lectures BIM and practice (Front, Boston)
[Final presentation. \(Students for 9-unit option\)](#)

class 13
Thursday
2024.05.09 [Final presentation. \(Students for 12-unit option\)](#)

Tuesday
2024.05.14 Last day of MIT classes

May 17-22 MIT Final Exam period
May 30-31 MIT Commencement

Textbooks and Reading Sources

None. All custom resource (digital files for tutorials and demonstrations, links to examples) are online. The followings include the snapshot of the resource page.

<http://cat2.mit.edu/4.567/2020s/samples.html>

Tutorial 00

Install Revit 2023/2024 (Use free educational version: Make sure to register as student)

Autodesk Revit Videos and Tutorials (Revit 2023/2024)

Linkedin Learning (Formerly Lynda.com) for MIT: This is a commercial site providing on-line software tutorials on video. Via the above link, MIT community members get free access if you use it on MIT network or with MIT certificate on your machine. Once you get into the home page, pull-down Browse the Library menu and click CAD. Revit appears under CAD Software category on the left column of the page. My suggestion for a new learner is to use the one for Version 2024 (choose it from the left column) such as Revit Architecture 2024 Essential Training with Paul F. Aubin.

Tutorial 01

Demo file: Revit 3D model modified from AutoDesk tutorial site (.rvt, 7MB)

Revit 2020 version, Revit 2024 version

4.560 Analytique

Photoshop Channel and Mask Demo

Demo file: images for photoshop demo (zipped jpg files, 1Mb)

Tutorial 02

Demo file: Citrohan House - Grid and Levels (.rvt, 2.5MB) Revit 2017 version

Revit 2019 version Revit 2020 version Revit 2024 version

Renaissance Revit by Paul F. Aubin: Interesting book on modeling classic elements in Revit

Autodesk A360 for sharing a project on cloud

Tutorial 03

D'Espouy Analytique

QuickTime example

Demo file: Citrohan House - Stairs, Curtain Wall, Link and Sheet (.zip, 2.7MB)

Revit 2017 version Revit 2019 version Revit 2024 version

Tutorial 04

Demo file: Citrohan House - Rendering, Photometric Lights and Textures (.rvt, 7MB)

Lighting fixture catalogue with photometrics

Illumination Transformation Example with IES Lights

Tutorial 05

Demo file: Citrohan House for site modeling (.rvt, 5MB)

Revit 2017 version Revit 2019 version Revit 2024 version

Sample Revit animations

Sample animations from 4.562

Demo file: Sample model for animation (.rvt 5.4Mb)

Revit 2017 version Revit 2019 version Revit 2024 version

Tutorial 06

Demo file: In-Place Element, In-Place Mass (.rvt, 5MB)

Revit 2017 version Revit 2019 version Revit 2024 version

Tutorial 07

Demo file: Custom Family part 1 and 2 (.rvt, 3MB)

Revit 2017 version Revit 2019 version Revit 2024 version

Tutorial 08

Demo file: Curtain Wall and Surface Division (included in the zip for of Tutorial 09)

Tutorial 09

Demo file: Conceptual Mass and Adaptive Placement Points (.zip, 2MB)

Revit 2017 version **Revit 2019 version** Revit 2024 version

On-line tutorials/samples

Tutorial 10

Shape Grammar examples

Demo file: NITROS plug-in for Autocad (.vlx 100k)

Demo file: Sample model for addendum (.rvt 7Mb)

Demo file: Adaptive Placement Point with XYZ axis arrow (.rfa 7Mb)

Demo file: VSTA example files (.rvt 6Mb) demo-09_VSTA_sample.zip

Tutorial 11

Dynamo: Dynamo script examples (The files to go with the class note handout.)

Dynamo: Revit project that works with the Dynamo script examples

Site of Ian Keough, who initially created Dynamo and his original Dynamo download site

Lab Fees (if any)

No cost for MIT architecture students. Students from other school may need to pay for the cost of 3D printing a small model.