

DESIGN OF ULTRA-LIGHTWEIGHT BUILDING SYSTEMS

EDITION 2 - ACADEMIC YEAR 2016/2017

PRACTICE-ORIENTED LEARNING EXERCISE MODULES

Learn to create successful examples from zero to hero

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DIGITAL FUNDAMENTALS – RHINO (12/4/2017)

Nebojsa Jakica, Arch. PhD

INTERFACE, COMMANDS, NAVIGATION

Interface, viewports & mouse navigation

Inputs & commands

Selection

Grid & object snapping

Geometric transformations

Geometric manipulation

Layers, groups & blocks

Object properties, visibility & representation

GEOMETRIC PRIMITIVES - POINTS AND CURVES

Points, planes, vectors

Lines, polylines, polygons, curves

Curve tools

Control points manipulation

GEOMETRY - SOLIDS AND MESHES

NURBS/Solids vs Meshes vs Tsplines

Solid primitives

Solid tools

Boolean operations

Polygon meshes

Mesh tools

NURBS SURFACES

Regular & freeform surfaces

Surface tools

Record history

Panelling

Annotation

EXERCISE - HANDS ON CASE STUDY

Case study to be defined

SOFTWARE NEEDED

<https://www.rhino3d.com/download/rhino/5/latest>

DIGITAL ADVANCED - GRASSHOPPER (19/4/2017)

Salvatore Viscuso, Arch. PhD

PARAMETRIC MODELING INTRO

Concepts of parametric modelling and Object Oriented Programming (OOP)
Visual/node-based vs command line scripting
Interface & commands
Geometric primitives -Points, Vectors, Planes
Lines, polylines, polygons, curves
Curve tools

PARAMETRIC 3D GEOMETRY

Regular & freeform surfaces
Surface tools
Solid primitives
Polygon meshes
Mesh tools

DATA MANAGEMENT & OBJECT MANIPULATION

Sets, lists, sequences, data trees
Data trees manipulation
Intersections
Transformations

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.rhino3d.com/download/grasshopper/1.0/wip/rc>

OPTICAL/LIGHT - LADYBUG TOOLS+VRAY (3/5/2017)

Nebojsa Jakica, Arch. PhD

OPTICAL/LIGHT ANALYSIS INTRO

Daylight simulation overview
Solar radiation mapping overview
Compliance with green building rating systems
Inputs: Weather data input and visualisation
Inputs: Optical characterisation of materials and composites
Inputs: Simulation parameters

SIMULATION

Climate-based daylighting simulation
Solar radiation mapping
Physically-based rendering and visualisation
Glare and user comfort

Visualising simulation data

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.food4rhino.com/app/ladybug-tools>

<http://www.food4rhino.com/app/ghpython>

<https://github.com/NREL/Radiance/releases>

<https://energyplus.net/downloads>

<http://daysim.ning.com/page/download>

https://www.vray.com/free_vray_demo/

FORMFINDING – RHINO MEMBRANE + KANGAROO (10/5/2017)

Salvatore Viscuso, Arch. PhD

TENSILE AND KINETIC STRUCTURES

Tensile structures: Springs, gravity, inflation and anchor points

Kinetic structures: bending and folding elements

Collision detection: particles and forces

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.food4rhino.com/app/rhinomembrane-v20>

<http://www.food4rhino.com/app/kangaroo-physics>

<http://www.giuliopiacentino.com/weaverbird/>

<http://www.food4rhino.com/app/meshedit>

ENERGY/THERMAL - LADYBUG TOOLS (24/5/2017)

Nebojsa Jakica, Arch. PhD

ENERGY/THERMAL ANALYSIS INTRO

Energy simulation overview

Compliance with green building rating systems

Inputs: Weather data input and visualisation

Inputs: Energy and thermal characterisation of materials and composites

Inputs: Energy loads

Inputs: Simulation parameters

SIMULATION

Energy consumption

Energy generation - solar

Indoor/Outdoor thermal comfort

Visualising simulation data

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.food4rhino.com/app/ladybug-tools>
<http://www.food4rhino.com/app/ghpython>
<https://github.com/NREL/Radiance/releases>
<https://energyplus.net/downloads>
<http://daysim.ning.com/page/download>

STRUCTURE – KARAMBA (31/5/2017)

Salvatore Viscuso, Arch. PhD

TENSILE AND KINETIC STRUCTURES

Finite Elements Method
Large deformation analysis
Galapagos optimization

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.karamba3d.com/>

DIGITAL PROTOTYPING (7/6/2017)

Nebojsa Jakica, Arch. PhD

ADVANCED FABRICATION & QUANTITY TAKE-OFFS

Slice surfaces, solids and/or meshes
Orient and Tagging pieces
Unrolling Breps
Nesting and preparing cutt-off layouts for a CNC
Adjusting geometry for a 3D printing
3D printing settings
Quantity take-offs

EXERCISE - HANDS ON CASE STUDY

SOFTWARE NEEDED

<http://www.food4rhino.com/app/lunchbox>
<http://www.tdmsolutions.com/rhinonest/>
<http://www.food4rhino.com/app/fabtools>
<http://www.food4rhino.com/app/generation>