Subject description

Faculty of Architecture, WUT 2020, **Architecture** studies

Architecture for Society of Knowledge speciality

Computational design		**ASK2-KW-Cd**	**MSc level**	**semester 2**
Classes: **lecture** **seminar**	Hours per semester **15** **30**	Student's own workload hours: **26**	Status: **compulsory** Level: **Advanced** **CONTEXT:** **workshop**	ECTS: **3** Exam: **yes**

Unit delivering this subject: Katedra Projektowania Architektonicznego, Pracownia Projektowania Architektonicznego Wspomaganego Komputerem
Subject coordinator: dr hab. inż. arch. Jan Słyk, prof. PW
Teacher(s): mgr inż. arch. Krzysztof Nazar

Learning outcomes and teaching methods

Objective of the course:

After completing the course, students have an in-depth knowledge of the principles of parametric design. Course continues issues taken by E1-Advanced CAD Techniques and methods based on object-oriented programming, but do not require previously acquired skills. Programming skills are not required, but a logical procedure in the steps which define more and more complex forms. Elementary exercises lead to master the ability to define own complex forms. The culmination of acquired knowledge is the ability to create a three-dimensional structure, according to the relationship defined by the author.
The main goal of the seminar is to raise awareness of the mathematical relationship between the creation of the form and structure of the object.

General description of the course:

Parametric design application supports the latest generation of architectural design software. Compared to other CAAD tools, where three-dimensional modelling, based on the definition of solid surfaces and mathematics, generative design use a parametric definition to determine relationships between elementary objects. Object created in the process is a structure of relationships. Traditionally understood concept of construction, walls, etc. is overvalued.

Mastering generative design requires a new approach to the concept of modelling. For this purpose, course carries more and more complicated elementary exercises. Concepts are introduced: 'properties of the object', 'methods' and 'parameter' originally belonging solely to high-level programming languages. 'Reactive component' definition is introduced, explained and applied in practice.

Understanding the philosophy of parametric programming and mastering the tool in particular, allows the students to implement their own vision of the project, limited only by imagination. The culmination of the seminar is to implement the geometric structure which forms answer the design task, for example, a skyscraper, a stadium, etc.

Learning outcomes

No. of the outcome/ area	Description
Knowledge	
W_01	Gives a theoretical underpinnings knowledge of parametric design.
W_02	Able to determine and formulate steps to implement the tasks of the project.
W_03	Design spatial form based on parametric and mathematics relationships of objects.
Skills	
U_01	Can use information techniques for parametric design.
U_02	Able to analyze and interpret the results of the activities.
U_03	Able to propose a strategy for the implementation of the proposed design concept.
Social competence	
KS_01	Able to interact and work in a team performing various roles.
KS_02	Can act and think in a creative way.

Learning contents:
Introduction to parametric design. Seminar overview, organization, topics and schedule. Computer lab rules.
Exercises overview and project task.
Implementation:

1. Tips for installing the necessary software
   - Selected Services Platform registration
   - Pre-install modules
   - Software installation
   - Software registration
2. Exercise 1 – 'Reactive Components' concept
   - theoretical task
   - model implementation
   - discussion, evaluation, publication
3. Exercise 2 – Free dynamic forms introduction
   - theoretical task
   - model implementation
   - discussion, evaluation, publication
4. Exercise 3 – 'Reactive Components' and Dynamic Forms compilation
   - theoretical task
   - model implementation
   - discussion, evaluation, publication
5. Main Project – 'Free Form Skyscraper'
   - theoretical aspects
   - vertical communication structure
   - building structure
   - facade structure
6. Final Presentation
   - e-platform publication
   - discussion
   - project exhibition
   - project evaluation

Teaching methods and forms :
Implemented mandatory lectures on a weekly basis, alternately in dimension 2 hours lecture + 1 hour of exercise and one hour lecture + 2 hours of exercise. Substantive content published on the e-

learning platform.
Elementary tasks - three basic exercises - bring the issue of generative design and form the basis for the implementation of its parametric structure, developed using the software 'Generative Components' Bentley.

Method of testing the learning outcomes

Outcome number	Way of testing
knowledge	
W_01	Lectures, literature, scored practical exercises
W_02	The implementation of mandatory sub-tasks evaluated by scoring
W_03	Elementary exercises presentation and final effects e-learning platform publication
skills	
U_01	Partial tasks - building of elementary models
U_02	Final structure - project presentation
U_03	Teacher and mutual evaluation
U_04	Experiences exchange between design process participants
social competence	
KS_01	Teamwork. Assessment based on observations during the course.

Literature

- Alasdair T.and Sean H. - ***Teaching Parametric Design In Code And Construction*** http://eprints.ucl.ac.uk/3284/1/3284.pdf
- Bobenko A., Pottmann H. and Wallner J. - ***A Curvature Theory for Discrete Surfaces Based on Mesh Parallelity***; 2010; Math. Annalen journal; http://www.geometrie.tugraz.at/wallner/pkmesh.pdf
- De Landa M. - ***The Philosophy Of Gilles Deleuze - Lecture/Video*** http://www.youtube.com/view_play_list?p=D649C765D91C1120
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http://www.technion.ac.il/~rivkao/topics/publications/Oxman_2008_Design-Studies.pdf

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