II-C-19 FAKULTET / SPECIAL ELECTIVE CLASSES
Prowadzący przedmiot: dr hab. inż. arch. Kazimierz Butelski, prof. PK
Ilość godzin: 15
Punkty ECTS: 2
Forma zajęć: seminaria i prezentacje studentów

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Cel:	Pokazanie procesu projektowania i powstania budynków w wyniku prototypowania. Zapoznanie studentów ze współczesnymi metodami projektowania, z pominięciem przygotowania dokumentacji – przejście od modelu do budynku z pominięciem tradycyjnej formy projektu. Kolejnym istotnym celem jest poszukiwanie nowości w architekturze i wykluczenie kopiowania istniejących obiektów. Wiedza: Student wie przy użyciu jakich zaawansowanych metod oraz narzędzi modelowania CAD i produkcji CAM powstają prototypy budynków. Kompetencje społeczne: Student wie, iż powstawanie prototypów oparte jest na szerokiej interdyscyplinarnej wiedzy i jest efektem pracy zespołu projektantów i konsultantów. Student rozumie orkiestrującą rolę architekta w tym procesie. Umiejętności: Student potrafi zastosować metody prototypowania w projektowaniu architektonicznym. Kompetencje społeczne: Student rozumie wpływ prototypowania na zmiany w dotychczasowym sposobie powstawania i projektowania budynków.
Opis tematyki:	1:1 – THE MODERN PROTOTYPE, AS A UNIQUE MODEL OF THE BUILDING 1:1 - The modern prototype, as a unique model of the building is optional subject at secondary level studies of the Faculty of Architecture Cracow University of Technology. Conducted in the Laboratory of Architecture Social Services - A24, as a complementary to the design of public buildings, since the academic year 2014/2015. Remarks and observations based of experiences and examples of first year implementation of this optional subject at the Faculty of Architecture Cracow University of Technology is the main scope of this article. I. The scope of issues Showing the process of how buildings arises as a result of prototyping. Filling the knowledge gap in the field of architectural design theory involving the creation of prototypes unique concept of building models in scale 1:1, using advanced methods and tools for modeling CAD and CAM production. Showing support to such actions on interdisciplinary and teamwork of the design process. Underling conceptual role of architect in design process. II. Form of communication. Conducted seminars based on the selected method of prototyping such as: cogging model, hygroscopic model, 3d printing model, self-assemble model, biological model. Exercises examples and researches which are presented during seminars were prepared in leading academic centers, such as ETH Zurich in Europe and MIT and Harvard University in USA.

	II. 1 Cogging model, idea - based on modern transformation of traditional wooden cogging joints idea, into multisurface smooth wooden structure where each cogging joint is unique. Such construction is possible due to advanced CAD CAM technology and robot prototyping. Using robots allows to produce precisely unique joints in consequence we are able to create flexible forms of buildings. (Landesgartenschau Exhibition Hall, Stuttgart, Achim Menges, Tobias Schwinn, Oliver David Krieg) II. 2 Hygroscopic model - based on observations of the nature and how the materials interacts with humidity. In Poland there is well-known traditional pavilion – center of weather forecast. Hair from a horse's tail changes its length with humidity and for this reason when the weather is good men is "going out" from the pavilion and when the weather is bad women is "going out" . Meteorosensitive Pavilion was also created based on this observation. In this case cone reacting with humidity was used as a base idea to create a self-moving structure of the wall. Deep study and research of wooden multisurface material and geometry combing with CAD and CAM technology allowed to create pavilion in Orleans. Previous experience from cogging joints was implemented into this pavilion too but now main idea was to put on improvement of environmental conditions. (Meteorosensitive Pavilion 2013, Achim Menges, Olivier David Krieg, Steffen Reichert) II. 3 3d printing model. Idea to print a building using 3d printer. At the beginning it looks very simple, however when it's comes to practice it becomes much harder. First of all there is a problem of scale. It is easy to print part of the building, but it is hard to do it as a whole complex solid. Digital Grotesque exercise performed at ETH Zurich show us problems and borders of implementation 3d printing into building creation. During this process limit of printers looks as follows: 4, 0 x 2, 0 x 1, 0 m, Resolution 0.13 mm thick. In this case design process takes 1 year, printing process 1 month, assembly process 1 day. Finally we have first printed entirely room 3.2 m high x 1, 2 m wide x 5 m bright. (Digital Grotesque. ETH Zurich. Michael Hanemeyer, Benjamin Dillenburger) II. 4 Self-assemble model - a process by which disordered parts build an order structure through only local interaction The process builds on multimaterial 3-D printing using a special material that can change its shape over time—and author call this process the fourth dimension. This intelligent-smart printed material can configure and reconfigure following environment conditions. The role of architect in design using this idea is different today because it focuses on process of creation of material that can be changed into programmed direction, in opposite to create building from readymade materials. (Skylar Tibbits, Self-Assembly Lab MIT). II. 5 Biological model - a concept to use animals to create a building. The idea is old because animals where widely used during history of architecture. However the idea that was implemented in design of Silk Pavilion in research supervising by Neri Oxman to use Silkworm (disambiguation) to create Pavilion is completely fresh and based on sophisticated research and exercise. CAD and CAM tools where used in process of creation to form complex geometry frame which was later filled by the animals follow people idea. (Silk Pavilion, Neri Oxman, MIT media LAB) III. Interaction and implementation

	In the Laboratory of Architecture Social Services - A24, during fall semester 2014/2015 MSc students of CUT were asked to prepare architectural design called: “Adam Mickiewicz Institute in Beirut”. This multipurpose building complex allowed a lot of possibilities for implementation of prototyping methods listed from above or even to present a new one. For several works design of Adam Mickiewicz Institute was not an exemplary project and they benefited from other projects carried out at the Faculty of Architecture Cracow University of Technology. Only several projects showed new methods of prototyping without the implementation of design. Final result was shown in 30 seconds CD multimedia presentation that contains the implementation of one of the presented methods of prototyping to selected project within the framework of compulsory classes. The other students prepared a presentation of a new method of prototyping that was not presented before. Next step was the discussion of scope in architectural design and potential impact of the prototyping to methods of design, forms of the buildings and methods of construction. In this context the role of the modern architect in this process of design was discussed. What need to be emphasize is that what is crucial in this process is the idea of creating more than just executing it. This experience thought should lead to a new approach to design and allow to solve design problems in a creative way. The expected result was to prepare students for creative prototyping of the buildings. Below are some examples of prototyping ideas applied in student designs. We distinguished three groups: ■ Application of earlier presented methods, ■ New methods and implementation, ■ New methods without implementation III.1 Application of earlier presented methods Mikołaj Kasprzyk - transform idea from wooden Meteorosensitive Pavilion into movable bimetal steel curtain wall in his Beirut Adam Mickiewicz Institute design. 3d printing elevation panels. Maciej Kolak show us idea of design and print elevation panel and then implemented this panel in his Beirut design. III.2 New methods and implementation Building Bits – 3d printing structure, presented by Anna Szudy was implemented in her Beirut design as an internal division green wall. Shadow and Sun – base for prototyping elevation. Idea presented by Małgorzata Śmietana based on sun and shadow analyzing in Beirut Mar Mikhail district and creation of this base external wooden steel frame system with different density to protect people inside the building. III.3 New methods without implementation Terms idea presented by Bogna Gramatyka. It is impossible to identify the command center in the termite colony. Somehow, termites share with you all the necessary information via chemical signals. Something very similar was made during 4 year experiment by the scientists working at Harvard University. Inspired by the behavior of termites, the Harvard research team designed the system TERMS, forming small inexpensive robots and software that allows them to build something unattended. Salt Crystallization – Mateusz Andres. Crystalized salt create a structure on earlier prepared spanned net between frames. This idea allows to create new forms of organic elevation and allows to use natural process of salt crystallization.

	IV. Conclusions. Prototyping as a process of design and implementation on construction site is still in a preliminary stage. However the direct implementation of 3d computer model into real building is possible. A lot of experiments shows that in final stage on construction site robots are more efficient than printers. Robots are better because they have no scale limits like printers have. But robots are more expensive than printers and for this reason we are looking for different strategies on how to use it in more efficient way. One of the most popular idea is to divide a problem and create a parts for assembly a complex form. Creation of printing intelligent materials is and interesting and promising direction but scale limits are the same like described above. As a result of experiments we can observe that prototyping methods combines with traditional ones on different stages on design and building process. Following this remarks we can note that today only a part of the building are prototyped. To look for relation between building and natural environmental processes is a very vital direction nowadays. Tools and software as well as materials used during prototyping process are different but still what plays the most important role – is people's imagination. That is why we shall put attention to education process in order to obtain creative thinking, that base technological knowledge which constantly changes. Conducting study exercises that involves designing of complex buildings in real conditions seems to be more interesting than doing it on experimental pavilions, because it helps to come closer to solve real designing problems. **Literature:** • N. Dunn, Digital Fabrication in Architecture, London 2012 • Glynn R. Sheil B. Fabricate: Making Digital Architecture, London 2013 • Gramazio F. Kohler, M., S. Langenberg, Fabricate: Negotiating Design and Making, Zurich 2014 • Heatherwick T. Rowe M., Making, London 2012 • N. Oxman, Virtual and Physical Prototyping, Cambridge 2011 • Iwamoto L. Digital Fabrications: Architectural and Material Techniques (Architecture Briefs), New York 2009 • A. Menges, Material Computation: Higher Integration in morphogenetic Design Architectural Design, London 2012 • Sheil B. Design Through Making, London 2005
Forma zaliczenia:	Obecność, esej, opracowanie prezentacji, prezentacja, obrona, udział w dyskusji,