

Department of Architecture and Media Technology, Aalborg University  
Department of Civil Engineering, Aalborg University

+ AKT II (Daniel Bosia)  
+ UN Studio (Christian Veddeler)  
+ 3XN/GXN (Kasper Guldager Jørgensen)

# UTZON(x) *Architecture Summer School*

UNFOLDING UTZON

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**UTZON (x) Architecture Summer School / August 2013**  
*19 - 30 August / Utzon Center / Aalborg / Denmark*

The aim of the summer school is to explore new approaches to design in the line of Utzon's work, by extending his design principles with the use of computational techniques in a parametric design environment. The summer school is a hands-on learning environment, where theoretical knowledge is coupled with physical and practical assignments related to the design theme.





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### *Theme for a summer school at the Utzon Center in 2013*

For many of Utzon's projects the roof is a variant on the folded-plate structures which fascinated Utzon. Folded-plate structures were not in themselves unusual for the late sixties, however Utzon had an ability to add layers of meaning without adding physically to the minimal structure. Utzon lifted well articulated folded-plate structures from role as an ornament into a modern construction, returning it to the constructive purity of its tectonic origin.

Construction of folded plates can be greatly simplified with the use of elements that can be easily operated by few people without the use of mechanical lifts. Innovative researches in rationalization of construction use optimization strategies to employ short and standardized components for the fabrication of free-form geometries, as in the case of reciprocal structures, where short standardized components can be used to generate potentially infinite variety of complex three dimensional structures. The combination of folded plates and reciprocal system is the point of departure to extend the line of Utzon's work with the introduction of computational techniques in a parametric design environment. In this framework the outcome of the summer school will be a 1:1 scale solution for a canopy over the Utzon Center courtyard.

### *Methodology*

When looking at the constitutive elements of Jørn Utzon designs, it is possible to discover original approaches to variation and repetition. Because of his awareness on the issues of construction, the repetition of a component becomes the expedient by which complex geometrical and constructional problems can be rationally solved, as in the case of the shells of the Sydney Opera House: the construction of their complex geometry was simplified and rationalized with a brilliant solution that allowed to employ only a limited set of standard mass-produced ribs components. The combination of prefabricated components in a structural assembly in such a way as to achieve a unified form that while incremental is at once flexible, economic and organic. Conversely, the variation of a component is related to his refusal of reductionist approaches: in his design he aims at embracing the complexity and the multifarious, therefore a structural component can vary its shape and adapt to the states of stresses he's subjected to, as for example the concourse beams of the Sydney Opera House. Its folded plate roof is made of an array of identical beams whose corrugation varies along their span to sustain adequately the prestressing and to be structurally most effective.

Among the possible ways to reconsider Utzon legacy, one can look at his strategies for variation and repetition in the light of the recent development of parametric modeling, computational techniques, digital fabrication and their application in architectural design. Parametric software enable the possibility to explore almost effortlessly infinite geometric variations that can be coupled with performance simulations, optimization, and iterative design processes, enriching and infinitely expanding a design space whose roots can be found in much of Utzon's work.

### ***Topics covered include***

#### Parametric design

- Introduction to parametric design
- Grasshopper interface, logic, data management
- Essential applied mathematics and geometry
- Grasshopper custom scripting components

#### Structural analysis and design

- Introduction to folded structures and relation to Utzon's departure for combination of pre-fabricated components in a structural assembly
- Finite Element Method
- Verification and optimization of folded structures

#### Environmental analysis and design

- Simulation of solar energy on folded surface
- Simulation of light within the court yard space from folded surface
- Quantitative/qualitative environmental optimisation

#### Physical experimentation

- Joints construction and testing
- Digital fabrication
- 1:1 construction of the final prototype

### ***Texts***

Extensive course slides will be made available prior to the course, further a literature list will be set up.

### ***Objectives***

Students who complete the module:

#### Knowledge

- Must have knowledge of parametric design tools that enable the generation of quick feed back loops from generation of form and performance analysis
- Must have knowledge of the relationship between form material structure and fabrication, which translates in the delicate balance between esthetic and technology in buildings.
- Must have knowledge about digital fabrication and testing

#### Skills

- Must be able to use parametric design tools to enable quick feedback loops between geometric exploration of form and performance analysis (structure, light, solar energy)
- Must be able to evaluate and interpret the results from the feedback loops in order to acquire an intuitive understanding of the behavior of the structural system in analysis and to be able to intervene by adjusting key parameters.
- Must be able to use tools for digital fabrication

#### Competencies

- Must be able to create a synthesis of architectural, structural and environmental requirements in complex buildings, by using parametric design tools that support the definition and control of advanced geometry, digital fabrication and performance analysis.





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### ***Prerequisite***

A BSc degree (Bachelor) in Architecture and Design or similar. No need of specific knowledge of Rhinoceros and Grasshopper is required

### ***Duration***

The summer school will run for two weeks from the 19th to the 30th of August 2013

### ***Location***

Utzon Center, Slotspladsen 4, 9000 Aalborg, Denmark

### ***Fees and registration***

<http://www.summerschool.aau.dk> (**DEADLINE: 1st May**)

When you apply and pay for the Utzon (x) Architectural Summer School you need to pay attention to the following.

You should choose one of the following package according to your personal background. Package B,D,F are not available during the Utzon(x) Architectural Summer School. You need to arrange for accommodation and meals yourself during your stay in Aalborg. The venue of The Summer School is at the Utzon Center at the harbor front in the centre of Aalborg close to all amenities.

Package selected:

Package A: DKK 750 (EUR 100)

- If you send a signed Learning Agreement, are a Aalborg University student or are Ph.D. Student.

Package C: DKK 3750 (EUR 500)

- If there is NO credit transfer of the course (no Learning Agreement) or you are a Post Graduate

Package E: DKK 9750 (EUR 1300)

- Non-EU/EEC Citizens (no learning Agreement).

For question in relation to the registration and payment please contact the Summer School secretary Hanne Høvring

### ***Workload***

4 ECTS

### ***Organization***

The summer school is a hands-on learning environment, where theoretical knowledge is coupled with physical and practical assignments related to the design theme.

### ***Assessment***

The module is passed by the student's regular and active participation in teaching/ evaluation seminars or the like and by compliance of the submission requirements.

The module is assessed by internal assessment.

### ***Examination***

Internal, oral/written examination.

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### *Summer School external lecturers*



**Daniel Bosia**, Director at AKT II and head of the specialist team p.art ®. He is newly appointment adjunct Professor at the Department of Architecture and Media Technology at Aalborg University. Daniel Bosia is a qualified Structural Engineer with an MSc in Structural and Bridge Engineering and a Master Degree in Architecture. He has worked at Arup for more than twelve years, collaborating with architects such as Daniel Libeskind, Toyo Ito and Enric Miralles and with artists such as Anish Kapoor, Antony Gormley and Matthew Ritchie. He has lectured in many Universities in Europe and the US such as UPenn, IIT, Yale, Columbia, Princeton and the Architectural Association. He is a Fellow of the Non Linear Systems of Organisation (NSLO) research center at UPenn. A cofounder of the Advanced Geometry Unit at Arup (AGU), Daniel has designed and delivered projects in the last few years, which have become icons of contemporary art and architecture. He has lead the AGU for more than 5 years from a cutting edge research unit to a profitable practice with a recognised brand, rich portfolio and exclusive client base.



**Christian Veddeler** is Associate Director and Senior Architect at UNStudio in Amsterdam. He received the degree Master of Science in Architecture from TU Delft, with Honours. Currently lead architect of the Singapore University of Technology and Design project. Concurrently, he is the head of UNStudio's Design Research Platform IOP, with a focus on emergent typologies in digital design processes. At UNStudio, Christian has collaborated on several projects, as the Galleria, Seoul, the Lelystad Theater, the Star Place in Kaohsiung and the St. Petersburg Dance Theatre. He was project architect for a series of pavilion projects, that focused on digital design and fabrication, including: The Holiday Home at UPenn's ICA, the Changing Room for the 2008 Venice Biennale, Chicago's Burnham Pavilion, the U-turn pavilion in Sao Paulo, Motion Matters at Harvard GSD and the New Amsterdam Pavilion in New York City. Christian has taught and lectured widely, amongst other places at TU Delft, the Berlage Institute and University of Illinois in Chicago.



**Kasper Guldager Jørgensen** is Partner in 3XN and Director of GXN; the innovation unit at 3XN in Copenhagen. He is Architect MAA, graduated from the Aarhus School of Architecture, 2005 and with a Master from Southern California Institute of Architecture, 2004

GXN was established in 2007 to exploit the possibilities that arise applying the latest knowledge and technology into design and architecture. The mission of GXN is to develop a building culture that positively affects the world we live in - both architecturally and environmentally. Kasper is passionately engaged in research and development of sustainability design, digital processes, and new materials. He sees a great potential in these areas and wants to take part in its exploitation. In the space of a few years he has become a spokesperson for the shape of future architecture, focusing on new business areas and integration of new materials and green technologies. Kasper Guldager Jørgensen is a much sought after lecturer at home and abroad and has completed numerous articles and book publications on new possibilities in materials, technology, and green architecture.

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### *Summer School organisers*



**Poul Henning Kirkegaard** is M.Sc. in Civil Engineering from Aalborg University, Aalborg in 1988 and PhD in “Experimental Design” from Aalborg University, Department of Civil Engineering in 1991. Poul Henning Kirkegaard has extensive experience in experimental/numerical analysis of the dynamic behaviour of structures, and has also been working within Structural Health Monitoring. Poul Henning Kirkegaard is today Full Professor at Department of Civil Engineering, Aalborg University in Innovative Design of Structures. His main current research areas are related to Adaptive Structures, Computational Morphogenesis, Tectonic Form & Design and Evidence Based Design.



**Dario Parigi** is Assistant Professor at the Department of Civil Engineering, Aalborg University, in Innovative Design of Structures and licensed architect in Europe. He is MSc in Architecture and Construction from Politecnico di Torino, Italy, and PhD in Cultural Heritage from the same University with a thesis that focuses on a novel algorithm for the design of free-form kinetic systems, developed in collaboration with the Departments of Housing and City, the Department of Civil Engineering, and the Building Technology Laboratory of the Massachusetts Institute of Technology (MIT). He investigates, within the main current research areas related to computational morphogenesis, kinetic structures, advanced architectural geometry, parametric and performance-based design, new forms of integration between engineering and architectural design. Currently his focus is on reciprocal structures, in particular their mathematical modelling, structural behaviour, optimization, fabrication and conceptual design. His works has been published and presented in international conferences. He is member of the International Association for Shell and Spatial Structures (IASS).



**Isak Worre Foged** is MSc.Eng.Arch. from Aalborg University, Aalborg and M.Arch. from EsArq, International University of Catalunya, Barcelona. Currently a PhD Fellow at Aalborg University, he explores a novel theoretical and methodological integration between environmental architecture, tectonics in architecture and computation. He is a member of SARC, research group for sustainable architecture, Aalborg University and OCEAN, Design Research Association. Isak co-founded the research based architectural studio AREA in 2010, located in Copenhagen. The studio runs parallel and intertwined with academia to develop and apply research into the built environment. Research and built works has been published and presented in Europe, Scandinavia and the US.



**Lasse Andersson** holds a master degree in Architecture from the School of Architecture in Aarhus 2003 and a Ph.D. from Department of Architecture and Media Technology at Aalborg University in 2009. A central area in his research is temporary architecture and instant urbanism as well as a genuine focus on the potential of research-by-design in architectural research within the universities today. He is one of the founders of the innovative project Platform4 merging new technologies and art. He has several curated exhibitions in the field of architecture and technology. He is currently associate professor at the Department of Architecture and Media Technology and Head of the Urban Design Section same place.