

institut für *konstruktion und*
koge *gestaltung*

institute of structure and design, university innsbruck



FORM - RULE
RULE - FORM **2013**
SYMPOSIUM
workshops *winter-term 2012 | 2013*

07.01. - 12.01.2013

Programme

9.15-9.30	Begrüßung/ Beginn der Lecture Series
9.30-10.25	Christoph Gengnagel - NFRP Profiles for Active Bending
10.30-11.25	Markus Hudert - Timberfabric - Textile Assembly Principles and Wood Construction
11.30-12.30	Annette Steinsiek und Ursula Schneider- Identifizieren, Fixieren, Katalogisieren – Schubladisieren?
PAUSE	
13.30-14.25	Toni Kotnik - ... there is geometry in architecture ...
14.30-15.25	Hubert Salden

9.30Uhr

Christoph Gengnagel NFRP Profiles for Active Bending

Materials suitable for active bending applications include timber, glass and carbon fibre reinforced composites and natural fibre reinforced composites (NFRP). Investigation of the mechanical properties, fabrication, and structural applications of NFRPs reveal the positive potential for their use in constructions in combination with elastic bending as form generator. Emphasis is given to the environmental advantages of NFRP's and the fabrication process of pultrusion. The potential use of elastically bent elements are presented in a case study of prototyping an irregular meshed elastic gridshell with 10m span.

10.30Uhr

Markus Hudert Timberfabric - Textile Assembly Principles and Wood Construction

The research work Timberfabric explores the interplay between assembly processes and the properties of the involved components and the potential of this interplay as generative factor in architectural and structural design. More specifically, it examines how principles of textile assembly techniques, in combination with elastically deformable timber elements, can be employed for the development of an innovative unit based construction system.

11.30Uhr

Anette Steinsiek und Ursula Schneider Identifizieren, Fixieren, Katalogisieren – Schubladisieren?

„form“, „rules“ und Bedeutungsvergabe im Literaturarchiv
Ziel der Erschließung eines Nachlasses im Literaturarchiv ist eine intersubjektiv nachvollziehbare Ordnung und Verzeichnung (die eine ökonomische Benutzung des Materials erst ermöglicht). Die vorgefundene „Ordnung“ oder auch „Unordnung“ wird zugunsten einer Praxis der Bearbeitung verworfen, die einerseits festgelegten Normen, andererseits der Expertise der ordnenden Person(en) folgt. Im vorliegenden Beitrag wird dargelegt, welche Formen verpflichtend sind (z.B. Provenienzprinzip, Trennung in Materialhauptgruppen), in welchen Fällen die Bearbeitenden „gestalten“ können, welche inhaltliche Bedeutung durch die Ordnung vergeben wird, aber auch, in welcher Weise die ursprüngliche „Ordnung“ dargestellt werden kann und wann dies überhaupt sinnvoll ist.

13.30Uhr

Toni Kotnik ... there is geometry in architecture ...

Beschreibung: Die Beziehung von Form und Regel kann als Abstraktion der historischen Beziehung von Form und Geometrie in der Architektur betrachtet werden, als eine Verschiebung von der Beschreibung der Form hin zur inneren Logik der Form. Die mit diesem Abstraktionsschritt verbundene Generalisierung des Formbegriffs hin zu einer Formalisierung von Zusammenhängen wird in der zeitgenössischen Architektur zunehmend zum bestimmenden Faktor im Entwurfsprozess. Damit tritt die Frage nach dem was und dem wie der Formalisierung in den Vordergrund und die damit verknüpften Frage nach den Einwirkungen und Veränderungen im architektonischen Denken. Der Vortrag ist ein Versuch der Annäherung an die Grenzen des Formalen in der Architektur und die Rolle des Formalen im Entwurfsprozess.

14.30Uhr

Hubert Salden to be announced

- 9.15-9.30 Begrüßung/ Beginn der Lecture Series
- 9.30-10.25 **Nobert Palz** - Additive Fabrikation
- 10.30-11.25 **Daniel Piker** - Designing constructable surfaces through physical simulation
- 11.30-12.30 **Martin Trautz** - Features of Foldings
- PAUSE
- 13.30-14.25 **Hans-Peter Schröcker** - The shapes of Walter Wunderlich
- 14.30-15.25 **Yves Klett** - Modulares Isometrisches Origami - Design und Prototyping
- 15.30-16.30 **Arnold Walz** -

9.30Uhr

Norbert Palz

Entwicklungen im Bereich der additiven
Fabrikation und digitaler Modellierung

Der Vortrag zeigt neue Entwicklungen im Bereich der groß- und kleinformatischen additiven Fabrikation und digitaler Modellierung und ihre mögliche Anwendungspotentiale im Baubereich. Auf theoretischer Ebene soll dabei eine Verbindung zu den Einflüssen technologischer Innovation und entwerferischer Praxis nachvollzogen werden.

10.30Uhr

Daniel Piker

to be announced

11.30Uhr

Martin Trautz

Features of Foldings

Folding is a common principle in nature used to gain structural stiffness of thin-walled elements like leaves, skins or wings or to induce movability or deployability of areas by division into parts and a structured retracting-process. In the context of human artefacts however foldings occur rather rarely, mainly as paperfolding and Origami-Art, or in singular technical applications. As far as deployability is demanded pleats or bellows are commonly used. In structural engineering geodesic domes and folded-plate-structures form a distinct category of structures. Despite of these advantageous basic technical features foldings have not been introduced as a fundamental conceptual principle for the design of spatial lightweight-structures in different materials or deployable coverings and claddings.

The technical features of foldings and the requirements for its application in structural engineering have been investigated at the chair of Structures and Structural Design ('Tragkonstruktionen') for several years. Starting with folded plate structures on basic geometries constructed from timber-plates or steel-sheets, nowadays folded plate structures with irregular principal forms and corresponding varying folding patterns, with several layers and different folding topologies are subject of detailed investigations. Focus is set on the generation of folding-patterns with the help of parametric programs as well as the realization in steel-sheet-construction using most innovative and variable sheet-forming-techniques like the Incremental-Sheet-Forming (ISF). Concerning deployable foldings different categories have to be distinguished, based on theories of mechanical engineering.

All of them, deployable as well as rigid foldings and folded-plate-structures, generate new classes of lightweight-and deployable structures.

13.30Uhr

Hans-Peter Schröcker

The shapes of Walter Wunderlich

Walter Wunderlich (1910-1998) was one of the most influential and productive Austrian geometricians of the 20th century. He served as professor of descriptive geometry at the Vienna University of Technology and published more than 200 scientific articles in the field of geometry and kinematics. In our talk, we present some of Wunderlich's contributions to shape finding. Here, Wunderlich usually studied particular geometric problems, often related to observations made in everyday life. His descriptions are very pictorial and clear. While they had little impact at the time of publication, they are nowadays recognized as pioneering works.

We illustrate this at hand of Wunderlich's description of the stable shape for the paper band model Möbius' one sided surface, his study of the equilibrium position of a net of equal-sided spatial quadrilaterals and his contributions to shaky, snapping and flexible polyhedra. Common to these topics is Wunderlich's wonderful original treatment, their later incorporation in more comprehensive but less easily accessible theories, and their relevance in modern architectural design.

14.30Uhr

Yves Klett

Modulares Isometrisches Origami -
Design und Prototyping

Einführung Leichtbau / Sandwich / Kernwerkstoffe

Modulares isometrisches Origami (MIO)

Computational Origami / Origami sekkei: Überblick und Werkzeuge

Mathematica(R) als Werkzeug: Einführung

MIO Design: Axiome

BYOMIO: Build your own MIO

15.30Uhr

Arnold Walz

to be announced

Christoph Gengnagel und Holger Alpermann

Active Bending

Der Kurs vermittelt Kenntnisse zu den Themen Formfindung, Tragverhalten und Konstruktion von einfach und doppelt gekrümmter Flächen- und Stabtragwerken. Schwerpunkte sind dabei Wirkungsweise und Einsatzmöglichkeiten von elastische Biegung als Formgebungsverfahren für diese Konstruktionen (Active Bending). Das Potential dieses Konzepts wird vertiefend am Konstruktionstyp der Elastischen Gitterschalen untersucht. Mit Hilfe physischer Modelle sollen im Rahmen eines Entwurfsworkshops auf einfache und anschauliche Weise die Grundprinzipien vermittelt, erprobt und in einem eigenen Entwurf angewendet werden.

Markus Hudert

Fabricating Form

Das Fügen von Elementen zu einem Ganzen ist eine Notwendigkeit bei der Realisierung von Gebäuden, hat darüber hinaus aber auch generatives Potential. Der Workshop „Fabricating Form“ untersucht in diesem Zusammenhang die Frage, inwieweit aus dem Zusammenspiel von Fügungsprozessen und Elementeneigenschaften architektonische Form entstehen kann. Ausgehend von streifenförmigen, elastisch verformbaren Elementen werden auf empirische Art und Weise neuartige Formen der Fügung entwickelt, welche die spezifischen Eigenschaften dieser Elemente berücksichtigen, beziehungsweise durch diese erst ermöglicht werden. Ausgangspunkt sind textile Prinzipien und Techniken, die dann im Verlauf des Workshops weiterentwickelt und modifiziert werden.

Toni Kotnik

Structural Design: Ein systemischer Ansatz

Beschreibung: Durch die Verfügbarkeit digitaler Methoden hat sich im architektonischen Entwurfsprozess in zunehmendem Masse ein systemisches Verständnis durchgesetzt. Dabei wird das klassische kompositorische Arbeiten mit primären Formen ersetzt durch ein relationelles Arbeiten in Beziehungsgeflechten. Ziel des Workshops ist eine einführende Auseinandersetzung mit diesem Entwurfsdenken am Beispiel eines Balkenrost. Durch Entwicklung von inneren geometrischen und tragstrukturellen Logiken und externen Regeln der Adaption soll die tradierte Typologie aufgebrochen und das architektonische Potenzial der Tragstruktur als räumliches Gestaltungsmittel exploriert werden.

Daniel Piker Designing constructable surfaces through physical simulation

Doubly curved surfaces can enable structural efficiency and have rich design potential. However, they also pose several challenges for fabrication and construction. Buildings are usually constructed from a number of discrete elements, which are somehow joined together into the overall designed form. The geometric properties of these elements can determine whether the structure is possible, affordable, and practical to fabricate and assemble.

Repetition, planarity, developability and clean junctions are often essential qualities for the elements.

However, these properties are intimately linked to the overall form and its pattern of division.

Pre-rationalizing, by working with simple geometric constructions, such as translational surfaces, can ensure geometric constraints are met, but sacrifices design freedom.

Post-rationalizing, by adjusting the division pattern and element geometry after the overall form is defined can be complex and non-intuitive, and may not be able to meet the constraints without altering the form from the design intent.

Therefore we will explore an approach based on embedded rationality where constraints are enforced continuously through simulation of physical forces.

We will design curved spanning structures which are self-supporting and incorporate cladding, with an emphasis on simplifying the elements and construction.

Norbert Palz Adaptive strukturelle Morphologie

Kleinformatige additive Fabrikation hat in den vergangenen zehn Jahren bei entwerfsbegleitenden Modelluntersuchungen ihre architektonische Anwendung gefunden. Der Workshop untersucht eine Anwendung der Prinzipien additiver Fertigungstechnologien im Maßstab 1:1 für den Entwurf architektonischer Bauteile mit heterogenem Aufbau. Der Kurs soll die Studenten dabei in die parametrische Modellierung von strukturell optimierten Strukturen auf der Ebene der Bauteilhülle und ihrer lokal spezifizierten morphologischen Innenstruktur einführen. Neben einer Unterweisung in die digitalen Modellierungsmöglichkeiten sollen die Studenten eine physische Materialisierung der digitalen Geometrie mithilfe CNC gesteuerter Werkzeuge durchführen.

Workshop wird mit Dipl.-Ing. Daniel Büning durchgeführt, Doktorand am DEE

Yves Kleff Modulares Isometrisches Origami - Design und Prototyping

Einführung Leichtbau / Sandwich / Kernwerkstoffe

Modulares isometrisches Origami (MIO)

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MIO Design: Axiome

BYOMIO: Build your own MIO



Christoph Gengnagel

After studying architecture and civil engineering in Weimar and Munich, Christoph Gengnagel went on to complete his dissertation on the theme of "mobile membrane construction." In 2006, he became a professor at the University of the Arts Berlin (UdK) where he took over the Department of Constructive Design and Structural Engineering. In 2008, the university's extended academic senate voted him the first vice president of the UdK. Parallel to his scientific work, Professor Gengnagel is also a partner at the office of a.k.a.ingenieure and participated, among other things, in the construction of Berlin's Temporary Art Hall.



Holger Alpermann

studied civil engineering and architecture at the TU Darmstadt and the TU München, diploma in civil engineering in 2002, diploma in architecture in 2004. He worked as a constructural designer at BWP, Munich from 2004 until 2007. Since 2007 he is working as a scientific assistant at the department of Constructive Design and Structural Engineering at the architectural faculty of the University of the Arts, Berlin.



Markus Hudert

studied architecture at the University of Applied Sciences in Coburg and completed his postgraduate studies in conceptual architectural design at the Städelschule in Frankfurt in 2002. From 2003 to 2006 he was based in the Netherlands, where he worked for UNStudio and Bentham Crouwel Architects. Since 2006 he has been research and teaching assistant at the IBOIS laboratory for timber constructions at the EPFL in Lausanne, where he is currently finalizing his doctoral research.



Ursula A. Schneider

Senior scientist at the research institute „Brenner-Archiv“ at the University of Innsbruck.

Studied in Vienna and Innsbruck. Dissertation in German philology at the University of Innsbruck. Scientific staff at the „Brenner-Archiv“ research institute. Employed at the „Brenner-Archiv“ since 2007. Several publications about „austrian literature and culture of the 20th century“ at the department of Editorial Studies and archive.

Annette Steinsiek

Senior scientist at the research institute „Brenner-Archiv“ at the University of Innsbruck.

Studied in Bielefeld and Bonn. Dissertation in literary studies at the University of Innsbruck. Scientific staff at the „Brenner-Archiv“ research institute. Employed at the „Brenner-Archiv“ since 2007. FWF project manager, several publications about „austrian literature after 1945“ at the department of Editorial Studies and archive. 2008-2011 organization and management of the workgroup „Archiv“ at the „Brenner-Archiv“.



Toni Kotnik is lecturer and researcher at the chair of structural design at the ETH Zurich and principal of d'HKL, a Zurich-based office focusing on research-oriented architectural design. He studied architecture and mathematics at ETH Zurich, CH, the University of Tübingen, D, and the University of Utah, USA, and received his doctoral degree from the University of Zurich, CH. He was research fellow at Center for the Representation of Multi-Dimensional Information (CROMDI), principal researcher at OCEAN design research network, postdoctoral researcher at the ETH Zurich, adjunct assistant professor at the University of Applied Sciences in Lucerne, CH, and studio master at the Emergent Technology and Design program at the Architectural Association in London, UK, and assistant professor at the Institute for Experimental Architecture at the University of Innsbruck. His practice and research work has been published internationally and is centered on the integration of scientific knowledge into the design process with focus on the relationship between digital architectural design, geometry and material behavior.

Hubert Salden to be announced



Norbert Palz after his apprenticeship as a architectural draftsman, Norbert Palz graduated 1999 with a diploma in architecture from the TU Berlin. From 1999 until 2002 he first worked at the UN Studio in Amsterdam and then at the NOX Architects in Rotterdam. In 2003 he and Robert Banovic founded TARGADESIGN. 2003 until 2005 Norbert Palz worked as a scientific assistant at the „Grundlagen des Entwerfens“ chair at the architectural faculty of the TU Kaiserslautern. In 2007-2012 he got his conferral of a doctorate at the THE ROYAL DANISH ACADEMY OF FINE ARTS, title: "Architectural Potentials of tuneable Materiality through additively fabricated Materials". Since 2010 he works as a professor at the Münster School of Architecture in the „Digitales Entwerfen und Konstruktion“ department and at the „Universität der Künste“ in Berlin at the „Digitales und Experimentelles Entwerfen“ department.



Daniel Piker is a researcher on the frontier of the use of computation in the design and realization of complex forms and structures. After studying architecture at the AA, he worked as part of the Advanced Geometry Unit at Arup, and later the Specialist Modelling Group at Foster+Partners. He has taught numerous studios and workshops (including the AADRL, and a cluster at SmartGeometry) and presented his work at conferences around the world.

He is the creator of the widely used form-finding physics engine 'Kangaroo', software which he continues to develop independently, as well as consulting and collaborating with a wide range of practices and researchers.



Martin Trautz after graduating 1989 at the University of Stuttgart he became research assistant at the Institute for Design and Construction under Univ.-Prof. Dr. J.Schlaich who also was his diploma supervisor. In 1990-1991 Martin Trautz worked as a structural engineer at Acer Consultants Ltd., Guildford/Surrey. From 1991- 1993 he worked as a structural engineer at Ove Arup & Partners in Leipzig and Berlin. In 1993 he became research assistant at the SFB 230 „Natural Structures“ at the Institute for Lightweight Structures (IL). In 1998 Martin Trautz got his PhD at the University of Stuttgart (supervisors Univ.-Prof. Dr. habil E. Ramm, Univ.-Prof. R. Barthel). At Bollinger+Grohmann Consultants in Frankfurt/Main he worked as a structural engineer from 1997-2002. In 2002 he founded the Office for Structural Design in Aachen and Kelkheim/Ts. Since 2005 he is the Head of the chair for structures and structural design at the faculty of Architecture at the Aachen University (RWTH Aachen). In 2011 he became Dean of the Faculty of Architecture of the Aachen University.



Hans-Peter Schröcker

studied mathematics and descriptive geometry at the University Graz and the Graz University of Technology. After positions at the University of Applied Arts in Vienna and the Vienna University of Technology, he joined the Unit Geometry and CAD at the University of Innsbruck in 2004. There, he did his habilitation and became Associate Professor in 2011. He also had a visiting position at The University of Tokyo (July 2010). His research profile includes classical geometry and its applications, kinematics and robotics, and also convex and discrete geometry.



Yves Klett

1996-2002: degreed engineer (Aerospace) / Universität Stuttgart, Germany 2003: SAMPE Deutschland Innovation Award „Auslegung und Simulation endkonturnah gefalteter Wabenstrukturen“
Since 2003 teaching and research assistant at the Institute of Aircraft Design (IFB), Universität Stuttgart, focus on design and production of technical tessellations (foldcores)
2005: CyberOne award for best business plan / founding partner of Foldcore GmbH



Arnold Walz after graduating in 1973 from the University of Stuttgart at the department for Architecture and city planning, specializing on building construction and planning theory, Arnold Walz became a worldknown „Achitect for Architects“. His company „Design for Production“ supports architects, planners, engineers, and contractors in the efficient design and production of non-standard architecture. Their principals are: „ORGANIZE OPTIMIZE SIMPLIFY MATERIALIZE“.

In 2001 he worked for WSI-Stuttgart, he drew the parametric 3D-Model of the Roof Geometry (concrete- and steel gridshell). From 2000- 2003 he worked for the Renzo Piano Building Workshop in Paris, where they made a parametric 3D model to optimize the buidling design of the Centrum Paul Klee in Bern. He also worked for the UN-Studio and ZÜBLIN on the New Mercedes-Benz. In 2006 he worked for Wenzel+Wenzel on the 3D geometry processing for the new Porsche Museum in Stuttgart.

The QUESTION behind the SYMPOSIUM

Form stands not only for an object's shape. Form also implements principles of its generation. Therefore form affects and effects most disciplines from language and literature to philosophy and biology. Form in architecture stands for its spatial (architectural) quality and simultaneously for its structural potential. Its architectural quality is the result of all respected parameters, its structural efficiency is directly correlated to its geometry which again can be perceived with our visual sense.

Form also reflects its principles and rules that are set up or found in its creation.

So Form and Rule can be seen as an interrelating and/or correlating system. The principles or rules that are set up or found in order to create form and space can be described as predefined or postdefined. At the same time we maybe face the classical "The chicken or the egg causality dilemma". What was first the Form or its describing rules?

The different approaches to "Form" which can be of physical, geometrical, material, aesthetic, social, ... nature can be of deep interest for all space creating disciplines, like architecture or engineering.

The aim of the lecture series, discussion and workshops is to recognize, better understand and develop the mostly separately examined aspects in the creation of forms as a complex holistic system. In this regard an inter- and transdisciplinary exchange can be seen as an important step in this direction and open new perspectives and possibilities for all involved disciplines.

Organization

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