

TOPICAL REPORT

DIGITAL DESIGN & FABRICATION

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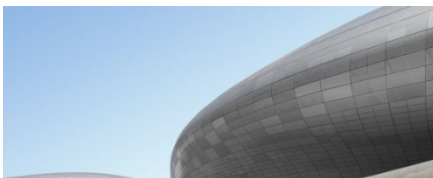
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DIGITAL FABRICATION



Parametric design: style and substance?

"Associate Professor M. Hank Haeusler, from UNSW Built Environment, says parametric design isn't just about creating unusual, 'wacky' shapes without expression and emotion. He believes it is quite the opposite.

Instead, he says, the most effective applications of computational design don't merely challenge the boundaries of design, they solve challenges through design."

Source: unsw

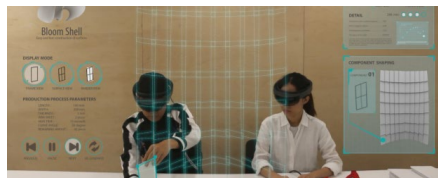
3D PRINTING



seoul-based studio SWNA 3D prints concrete to fabricate 'the curtained wall'

"SWNA explores strategies of digital fabrication in the creation of its 3D printed concrete installation 'the curtained wall' for the gwangju design center. before the printing process, the team of experimental designers virtually model the five the curtained walls, simulating a windy effect in three dimensions, and capturing the curtains that were

AUGMENTED REALITY



BloomShell - Augmented Reality for the assembly and real-time modification of complex curved structure

"This paper addresses whether AR can guide unskilled labour on complex structure assembly and fabrication process. It contains three experiments developed with AR. The research aims to prove that with intuitive holographic instructions, AR helps to reduce the time spent in comparing 2D drawings to the real site during the assembly process, and therefore offers possibilities to improve the construction efficiency significantly. The research also paves the way for shell structures, considering the latest technology such as AR and AI, and gives emphasis on the communication between computer and human during the fabrication process through the physical model."

Source: eCAADe

An open-source bio-based material system development for sustainable digital fabrication

"This work proposes an open-source mycelium-based construction material development, emphasizing on three interrelated steps. Firstly, the fungi growth based on Pleurotus ostreatus mycelium. Secondly, the digital production of custom

ADDITIVE MANUFACTURING



3D Printing and the Future of Supply Chains

"3D printing has become a trusted technology across various sectors, from printing of customized pills and medical devices to the manufacturing of aviation components. Download this trend report to explore the implications and use cases of 3D printing in logistics."

Source: DHL.com

affected by this environment. the organic geometry, once captured, is further digitally modeled to conduct structural research so that the wall can stand on its own. collaborating with korea-based concrete 3D printing company CORONA, two or more nozzles of the 3D printer were used to produce a stack by extruding concrete through the nozzles."

Source: Design Boom

Revitalizing Biodiversity with 3D-Printed Coral Tiles

"Following the 3D-printed footsteps of previous efforts to save coastal marine biodiversity utilizing technology and biomimicry, architects and marine scientists at the University of Hong Kong (HKU) have jointly developed a novel method for coral restoration making use of specially designed 3D-printed artificial 'reef tiles' for attachment by corals to enhance their chance of survival in the Hoi Ha Wan Marine Park in Hong Kong waters."

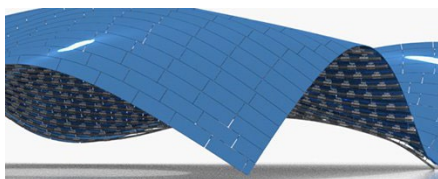
Source: Design Milk

Stratasys PolyJet Used for Direct-to-Textile 3D Printed Clothing

"Now, Stratasys is working with two new fashion designers, Julia Koerner and Ganit Goldstein. This collaboration follows on the heels not only of their unveiling the new ability to 3D print onto fabric, but also new examples of such techniques via other designers like threeASFOUR and Travis Fitch. The announcement at New York Fashion Week last year and following haute couture works were apparently just a foreshadowing of the innovative work to come."

Source: 3D Print.com

DIGITAL DESIGN



realize the formerly impossible with dassault systemes xGenerative design tool

"from 2010 onwards, the advancements of computational design has strengthen the belief that creatives can mass customize pretty much everything in a building. these applications have transformed practices as well as even the ideas of how we perceive space. the emergence and democratization of visual coding accelerated this trend. students and professionals alike have been enabled to create and control complex shapes with just a couple of nodes, and this is where the

formworks and material casting for uniform growth and building components creation. Finally, the construction technique investigation based on layering and stabilization of components. Through the suggested open-source bio-based material system development, the aim is to provide an alternative approach in construction that involves an ecological material with low environmental impact, interrelated with digital fabrication and assembly processes."

Source: eCAADe

3D PRINTING



Design and 3D Printing Methodologies for Cellulose-based Composite Materials

"In this paper, we present material experiments and digital design and fabrication methodologies for cellulose-based composites, to create porous biodegradable panels. Cellulose, the most abundant biopolymer on Earth, has potential for differentiated architectural applications. A key limit is the critical role of additive fabrication methods for larger scale elements, which are a subject of ongoing research. In this paper, we describe how controlling the interdependent relationship between the additive manufacturing process and the material grading enables the manipulation of the material's performance, and the related control aspects including printing parameters such as speed, nozzle diameter, air flow, etc., as well as tool path trajectory. Our design exploration responds to the emerging fabrication methods to achieve different levels of porosity and depth which define the geometry of a panel."

Source: eCAADe

Integrating biophotovoltaic and cyber-physical technologies into a 3D printed wall

"The paper explores the complex design negotiations between these drivers, focusing particularly on their performance optimization, and finally highlights the system potential as exemplified through a successful implementation of a 1:1 site responsive wall prototype."

Source: eCAADe

3d Printed Bio-hybrid Structures - Investigating the

architectural potentials of mycoremediation

"In this paper, we present a speculative design concept for a mycelium-based living bio-hybrid architectural system. The system combines inoculated lignocellulosic substrates with soil-based 3d printed structures that function as growth scaffolds, material boundaries and spatial organisers. The primary objective of the system is to exploit mycelium as a living remediator of contaminated sites, in the form of architectural proposition."

Source: eCAADe

PARAMETRIC DESIGN

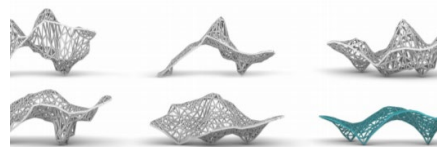


Concept Learning Through Parametric Design - A learning situation design for parametric design in architectural studio education

"The purpose of this paper is to observe the evolution of students' understanding when shifting from a traditional teacher-student relationship to an engaging learning environment, considering the specificities of parametric, and not to suggest a strict method to follow when learning parametric. This could guide teachers to adapt to their own situations."

Source: eCAADe

ROBOTIC FABRICATION



A Design Computation to Robotic Production Methods for Reciprocal Tessellation of Free-form Timber Structures - Design, production, and assembly of 100 years Bauhaus wood Pavilion

"this paper presents an integrated computational design to robotic production process of a free form wooden pavilion with a non-uniform tessellation pattern with differentiated cell sizes. The case study, on the one hand, elaborates on the challenges of solving reciprocal tessellation on complex geometries, and on the other hand, discusses the chosen and developed robotic production approach as a feedback loop that informs the design process."

Spatial Timber Assembly - Robotically Fabricated Reciprocal Frame Wall

"This project investigates the use of robotic fabrication to cut and assemble a timber reciprocal frame assembly. A computational model was created to generate the double-curved reciprocal frame geometry. Within this computational framework, joint analysis, fabrication, and assembly were monitored and adjusted to meet limiting factors. An industrial robot was implemented as a bridge between the computational model and the physical construction. This paper presents a number of novel computational and robotic fabrication techniques in designing, cutting, and positioning. These techniques were explored through the robotic fabrication and assembly of a demonstrator - a double-curved reciprocal frame wall."

Source: eCAADe

Application of Robotic Technologies for the Fabrication Of Traditional Chinese Timber Joints

"Our paper will explore how the Dougong components could be reinvented through the use of parametric tools and robotic fabrication methods and thus applied to contemporary architectural structures. We will analyse and compare the properties of the original Dougong with the reinvented unit by using finite element analysis and digital optimization tools. Our findings will provide an insight into the traditional construction principles of the joint and how these can inform a design and fabrication framework for its application in contemporary buildings."

Source: eCAADe

Robotic Swarms in Architectural Design - A communication platform bridging design analysis and robotic construction

"The goal is the development of a streamlined methodology that guides the conversion of a design model into construction data code that can be assigned to the robotic swarm for fabrication. The work focuses on bridging architectural design platforms and distributed automation processes, on the one hand, and on the other, it targets the development of a functional management tool for adjusting and optimizing fabrication. A crucial parameter considered is the monitoring and assessment of all stages of the proposed process."

Source: eCAADe

Source Material Oriented Computational Design and Robotic Construction

"This study proposes a new, real-time scanning-modeling system for obtaining material information, and incorporating the data into a continuous digital chain of computational design and robotic construction. After collecting and visualizing the data, the calculation portion of the chain processes the selection of source materials and generates architectural geometry based on both human-designed rules and various shapes of materials. Finally, at the action end of the chain, an industry robot is used to fabricate the design. End-effector is designed for tightly gripping the irregular source materials. Scripts is written in Grasshopper for positioning the components and assemble them into configurations. This study also shows a pavilion developing with the continuous digital chain"

Source: eCAADe

Designing with a Robot - Interactive methods for brick wall design using computer vision

"The paper will present and discuss the methodological and design challenges of interactive robotic fabrication of brickwork with an industrial robotic arm, a webcam and bricks with varying color tones. Emphasis will be on the integration of external computer vision libraries within Rhino Grasshopper to augment the interactive robotic process. The paper will describe and demonstrate a framework comprising (1) robotic pick and place, material selection and evaluation using computer vision, (2) interactive robotic actuation and (3) the role of human input during a probabilistic fabrication-based design process."

Source: eCAADe

Traditional Knowledge on Modern Milling Robots - How CNC-joinery machines promote a renaissance to lost techniques in the profession of a carpenter.

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(2) interactive robotic actuation and
(3) the role of human input during a
probabilistic fabrication-based
design process."

Source: eCAADe

**Robotic Fabrication with
Bioplastic Materials - Digital
design and robotic production
of biodegradable objects**

"The paper presents a number of
recipes on how to create bioplastics
in a DIY manner. Moreover, the
material research methodology, as
well as robotic fabrication strategies
behind each of the projects, are
discussed in detail."

Source: eCAADe

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