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TOPICAL REPORT

DIGITAL DESIGN & FABRICATION

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news

DIGITAL FABRICATION

DFAB House / NCCR Digital Fabrication

"DFAB HOUSE marks the first time that a full scale, the inhabited multi-story building has been designed and built using advanced digital fabrication methods. The project is the result of a nationwide interdisciplinary research initiative in Switzerland, called NCCR Digital Fabrication, aimed at transforming the design and building process by integrating computational design and digital fabrication into architecture. Its design concept is based on leveraging the full architectural potential of selected novel digital building processes in the field of robotic fabrication and 3 D printing technologies through integrated processes."
Source: Archdaily

Next Step in Structural Glass – Digital Design and Fabrication

"The glass/ glass composite panel can enable us to design bigger spans while preserving natural resources which is another increasingly pressing parameter influencing our current designs."
Source: Glass on Web

Space10 shares platform for people to create "dream home" for bees

"the Bee Home project lets anyone with a computer and internet access

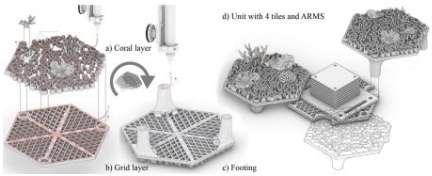
academic

DIGITAL FABRICATION

Designing with Uncertainty - Objectile vibrancy in the TOROO bamboo pavilion

"This paper challenges digital preoccupations with precision and control and questions the status of tolerance, allowance and error in post-digital, human-centred architectural production. It uses the participatory action research design-and-build project TOROO, a light-weight bending-active bamboo shell structure, built in Hsinchu, Taiwan, in June 2019, as a demonstrator project to discuss how protean digital design diagrams, named 'vibrant objectiles,' are capable of productively absorbing serendipity throughout project crystallisation processes, increasing designer agency in challenging construction contexts with high degrees of unpredictability."
Source: CAADRIA Conference

ROBOTIC FABRICATION



Reformative Coral Habitats - Rethinking Artificial Reef

reports

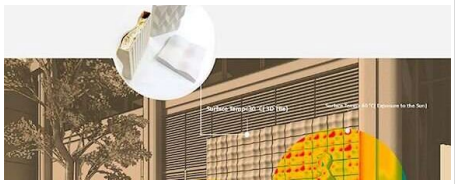
ADDITIVE MANUFACTURING

Additive Manufacturing—Past, Present, and the Future

"This chapter provides a rough overall view of the current state of additive manufacturing, how the status quo was reached and what the future looks like, and how these issues are related to the Manufacturing 4.0 context. Chapter focuses on the most developed and studied form of additive manufacturing—laser based powder bed fusion of metal materials. Main challenges, possibilities, and technology readiness-level are presented together with a discussion about the approximate costs related to manufacturing with the-state-of-the-art systems."
Source: Technical, Economic and Societal Effects of Manufacturing 4.0

design their own insect habitat using Space10's online platform. The user can then download the design files and forward them to their local CNC machine-owner, where it can be built using digital fabrication."
Source: Dezeen

CERAMIC FABRICATION



Ceramic skins insulate and protect city buildings and inhabitants

"When applied to the surfaces of buildings, her interlocking hollow ceramic tile systems provide protection from cold, heat and noise. Her Fireless Skin design is a system of hollow ceramic building tiles that are filled with mycelium to improve the thermal and acoustic properties of walls and structural surfaces. The tiles feature customisable decorative surfacing and glazing options created using digital and traditional production technologies."
Source: TechXplore

3D PRINTING

gramazio kohler research, ETH zurich plants the 'future tree' in a swiss courtyard

"'the future tree's stem is a reinforced concrete column, made using an ultra-thin formwork, 3D-printed by a robot, and filled with a custom developed fast-hardening concrete,' explains the design team. 'this novel fabrication process, known as 'eggshell', allows for the fabrication of non-standard, structurally optimized concrete structures, whilst being able to integrate standard reinforcement and minimize formwork waste. the eggshell process makes use of fused deposition modelling (FDM) 3D printing in order to achieve a wide design and fabrication space.'"
Source: Design Boom

Armis Slide: 3D Printed Shoes Made in a Single Print

"3D printing has had an revolutionary impact on the industrial world at numerous levels. While in some areas, researchers are producing groundbreaking studies and inventions as in medicine, other innovators are focused on improving

structures through a robotic 3D clay printing method.

"This paper describes the present research that focuses on the design and fabrication of artificial reef structures utilizing a robotic 3d clay printing method addressing the specificities of Hong Kong marine ecologies. The paper describes further the algorithmic design methodology, the optimization processes in the generation of the printing path, and the methodology for the fabrication processes during the production cycle to achieve even quality and prevent cracking during the drying process."
Source: CAADRIA Conference

Technologies and Techniques for Collaborative Robotics in Architecture - - establishing a framework for human-robotic design exploration

"This study investigates the technological and methodological challenges in establishing an indeterministic approach to robotic fabrication that allows for a collaborative and creative design/fabrication process. The research objective enquires into how robotic processes in architecture can move from deterministic fabrication processes towards explorative and indeterministic design processes."
Source: CAADRIA Conference

Robotown

"The potential robotization of architecture, its fabrication and assembly impacts design education today. In the near future it will contribute to the emergence of the new forms of urbanization. Our design research is focusing on the small scale urban conditions and build fragments that make up intelligent city. It is undertaken by the multidisciplinary team of architects and mechatronics engineers in academic context. The ROBOtown is understood as an urban structure containing intelligent town fragments. It has to consider the participatory design process involving architecture, mechatronic, robotics and lessons derived from Industry 4.0."
Source: CAADRIA Conference

Sustainable Sonic Environments - The Robotic Fabrication of Mass Timber Acoustic Surfaces

"This research proposes that mass timber panels can not only enable a new type of architecture that is sustainable, but that also sounds better. As mass timber construction often exposes the wood structure, and these panels are carefully constructed in factory settings, these panels have the potential to be built so that the acoustically absorptive,

essential needs, like clothing and shoes. That doesn't mean, however, that they aren't having fun in doing so. The latest in 3D printed footwear has just been released by Yanko Design, featuring some pretty cool (and comfortable looking) designs that they claim to 3D print in one hour."
Source: 3DPrint.com

COBOD joins GE Renewable Energy & LafargeHolcim to 3D print bases for 200-m-tall wind turbines

"A new partnership forged between GE Renewable Energy, COBOD International and building materials company LafargeHolcim will seek to develop optimized 3D printed concrete bases for wind turbines to make them taller and more cost effective. The turbines, which are expected to reach record heights of 200 meters, will be co-developed through a multi-year collaboration that seeks, overall, to increase renewable energy production while lowering the Levelized Cost of Energy (LCOE)."
Source: 3DPrinting Media Network

A biomimetic robotic finger created using 3-D printing

"Researchers at University of California- Santa Cruz and Ritsumeikan University in Japan have recently designed and fabricated a robotic finger inspired by the human endoskeletal structure. This biomimetic robotic finger, presented at this year's International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), was assembled using a multi-material 3-D printer."
Source: TechXplore

TIMBER FABRICATION

HexBox Canopy / DTC + CodeToProduction

"The HexBox Canopy is an experimental segmented timber shell, consisting of prefabricated hexagon-shaped boxes made from plywood plates. Since antiquity, arched spatial structures such as masonry vaults and domes have played a fundamental role in architecture, enabling the covering of wide spans without the use of intermediate supports as well as dramatically reducing the amount of required material."
Source: Arch Daily

METAL FABRICATION

reflective, or sound scattering acoustic properties of surfaces can be integrated into the constructive logic and architectural aesthetic of the building. This paper specifically investigates the potentials of the sound scattering performance of cross laminated timber (CLT) panels. Through design, simulation, and prototyping various surface designs are investigated."
Source: CAADRIA Conference

Sustainable Sonic Environments - The Robotic Fabrication of Mass Timber Acoustic Surfaces

"The paper introduces a new algorithm to get the analytics solution. The algorithm is clear explained by mathematics and geometry ways. At the end of paper, a grasshopper custom plugin is provided, which contains this new algorithm ,with this plugin, people can get the optimized target path plane more easily."
Source: CAADRIA Conference

Robotic Connections for CLT Panels

"This project creates connections inspired by traditional Japanese joinery that have been adapted to be used for the panel construction of CLT structures. Using a combination of digital modelling and advanced digital fabrication, the project utilizes CLT offcuts as a primary connection material. The system not only reduces waste but also mitigates thermal bridging and lowers the number of connection points whilst increasing the ease of building and fabrication."
Source: CAADRIA Conference

Robotic Sand Carving - Machining Techniques Derived from a Traditional Balinese Craft

"This paper presents research aimed at translating Ukiran Pasir Melela, traditional Balinese sand carving, into a new robotic-enabled framework for rapidly carving stiff but uncured cement sand blocks to create free-form and architecturally scalable unique volumetric elements. The research aims to reconsider vernacular materials and craft through their integration robotic manufacturing processes and how this activity can provide localized, low energy manufacturing solutions for building in the Anthropocene."
Source: CAADRIA Conference

A New Algorithm to Get Optimized Target Plane on 6-Axis Robot For Fabrication

"The paper introduces a new algorithm to get the analytics solution. The algorithm is clear explained by mathematics and geometry ways. At

2020 FAB 40: Metal fabricators show resiliency in crisis

"The 2020 FAB 40 stands apart from previous years, for obvious reasons. Glance at the list and you see a statistical slice of custom and contract metal fabrication as it was at the beginning of 2020—a very different time. That said, seeing how fabricators entered the crisis gives an idea of how they will emerge. Current events may well prove just how resilient metal fabrication really is."
Source: The Fabricator

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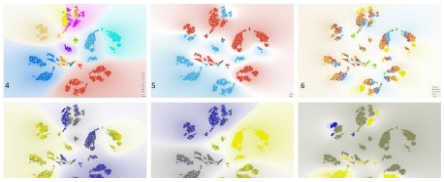
Source: CAADRIA Conference

DIGITAL DESIGN



t-SNE: A Dimensionality Reduction Tool for Design Data Visualisation

"We argue that data, in particular n-dimensional, is often hidden even in BIM models. Hence we propose a new way of understanding the space by (1) generate and integrate space analytics data using space syntax method as well as space usage data and (2) visualise the data using t-Distributed Stochastic Neighbour Embedding (t-SNE), an unsupervised learning and dimensionality reduction tool to help intuitively display high dimensions of data. This approach may help to discover the 'hidden layers' of the building information that may be otherwise omitted. This investigation, its proposed hypothesis, methodology, implications, significance and evaluation are presented in the paper."
Source: CAADRIA Conference

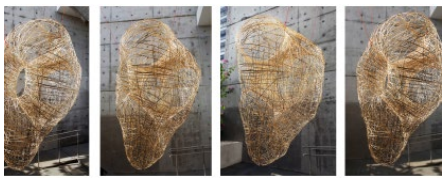
Recognizing Architectural Objects in Floor-plan Drawings Using Deep-learning Style-transfer Algorithms

"This paper describes an approach of recognizing floor plans by assorting essential objects of the plan using deep-learning based style transfer algorithms. Previously, the recognition of floor plans in the design and remodeling phase was labor-intensive, requiring expert-dependent and manual interpretation."
Source: CAADRIA Conference

Computational Tools in Architecture and Their Genesis: The Development of Agent-based Models in Spatial Design

"The research explores in what regard multi-agent systems (MAS) are representative as much from the existence of these socio-technical networks as of how their development influences the tension between tacit and explicit knowledge at play in procedural design processes and of the strategies architectural designers develop to resolve this tension."
Source: CAADRIA Conference

AUGMENTED REALITY

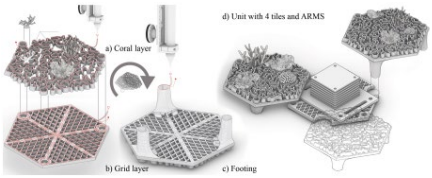


Augmented Reality-based Collaboration - ARgan, a bamboo art installation case study

"This paper critically evaluates the experience of extending recent AR and MR tool developments towards applications that centre on creative collaborative production. Using ARgan as a demonstrator project, its developed workflow is assessed on its ability to transform a geometrically complex digitally drafted design to its final physically built form, highlighting the necessary strategic integration of variability as an opportunity to relax notions on design precision and exact control. The paper concludes with a plea for digital technology's ability to stimulate dialogue and collaboration in creative production and augment craftsmanship, thus providing greater agency and more diverse design output."

Source: CAADRIA Conference

3D PRINTING



Reformative Coral Habitats - Rethinking Artificial Reef structures through a robotic 3D clay printing method.

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Source: CAADRIA Conference