

TOPICAL REPORT

DIGITAL DESIGN & FABRICATION

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DIGITAL FABRICATION



Scientists Streamline The Design And Fabrication Of Soft Assistive Wearables

"A team of scientists from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) has got past this hurdle with a pipeline called 'PneuAct' that uses an autonomous machine knitting process to design and digitally fabricate soft pneumatic actuators."

Source: Designboom

3DKnITS: Three-dimensional Knitted Intelligent Textile Sensor

"We present an approach to develop seamless and scalable piezo-resistive matrix-based intelligent textile using digital flat-bed and circular knitting machines. By combining and customizing functional and common yarns, we can design the aesthetics and architect and engineer both the electrical and mechanical properties of a sensing textile."

Source: MIT Media Lab

A Science of Buildings That Can Grow—and Melt Away

"Architect Neri Oxman, creator of 'material ecology,' explains how silkworms, shrimp shells and insect exoskeletons could help shape the city of the future"

Source: Wall Street Journal

3D PRINTING



A Review on Printed Electronics with Digital 3D Printing: Fabrication Techniques, Materials, Challenges and Future Opportunities

"we review the most commonly used substrates, electronic printing materials, and the widespread printing techniques employed at the industrial level, giving an overall vision for a better understanding and evaluation of their different features. The technical challenges of several contact and non-contact techniques with corresponding solutions are also presented."

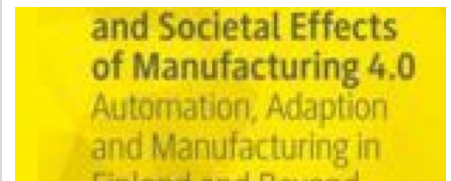
Source: Journal of Electronic Materials

BIO-FADEN 2.0 Pavilion: Experimental Study of Algorithmic-Generative Design and Digital Fabrication with 3D Printing of a Bionic Pavilion Prototype in the Midwest Region of Brazil

"This research has as main objective to determine the possibilities and limitations of digital design and digital fabrication by 3D printing of a prototype of bionic pavilion with non-Euclidean geometric shapes in reduced size inspired by fruits present in the Midwest Region of Brazil."

Source: Sigrada

ADDITIVE MANUFACTURING



3D printing trend report 2022

"This free report tracks the changes in additive manufacturing, from market growth following the coronavirus outbreak, trends in 3D printing applications, and industry predictions for 2022 and beyond."

Source: hubs

The mainstreaming of additive manufacturing

"Today, the risks of an industrial-scale AM installation are all carried by the end user. And these barriers can make it extremely difficult to build a business case for direct manufacture using AM technologies. Overcoming them is a challenge for the whole sector. Equipment makers could make further improvements in speed, end-to-end automation, and integration with existing manufacturing systems, for example, while materials providers could address issues around certification, availability, and cost."

Source: McKinsey

Maritime Singapore Additive Manufacturing Landscape Report 2022

"This report will share Maritime Singapore's additive manufacturing landscape, and seeks to promote greater awareness, learning and opportunities in the maritime industry."

Source: Maritime Singapore

This Multipurpose Tiny Office Was Digitally Fabricated For Self Assembly From A Flat Pack Design

"'A Room In The Garden' provides a working sanctuary for parents in urban areas to get away from the hustle and bustle of city streets and their children. The floor-to-ceiling window even offers a clever vista point for parents to supervise their children's playtime while still having their own quiet space."

Source: Yanko Design

3D PRINTING



3D-Printed Alternative to Yoga-Ball-as-Chair?

"The Bikechair was created as an exercise (promotion?) in conjunction with Delta Wasp, a manufacturer of industrial 3D printers. If the yoga-ball-as-chair thing took off, this is how a 3D printing powerhouse would attempt to capitalize on it."

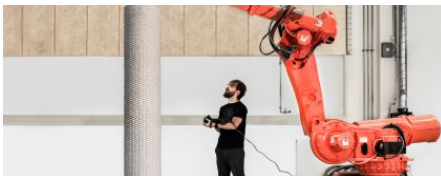
Source: Core77

3D Printing Silica Glass

"Additive manufacturing, more commonly known as 3D printing, has seen increasing application in multiple industries in the past couple of decades for multiple uses. A research paper currently in the pre-proof stage of publication in the journal Additive Manufacturing has investigated the 3D printing of silica glass components."

Source: AZO Materials

ROBOTIC FABRICATION



robotically crafted CoDe facades reinterpret swiss woodcraft tradition

"CoDe façades is an innovative process for designing and fabricating unique, cost-efficient, and well-crafted custom wooden facades. the project started as research work between the FHNW academy of art and design and ERNE AG holzbau in response to the growing need for flexibility and adaptability in the construction industry while keeping

Fracture studies of 3D-printed continuous glass fiber reinforced composites

"In the current study, fracture behavior of 3D-printed fiber-reinforced composites and steel specimens was determined and compared. Particularly, the Fused Filament Fabrication (FFF) process was used to print Semi-Circular Bending (SCB) composite specimens. In this context, nylon and glass fibers were used as matrix and fiber reinforced materials, respectively."

Source: Theoretical and Applied Fracture Mechanics

Fast prototyping in ceramic injection molding with 3D printed sacrificial molds

"The cost and time-intense mold making often limits widespread use of ceramic injection molding (CIM), especially during the prototyping phase of a project, when multiple iterations of design, fabrication and testing are required. We seek to speed up prototyping by 3D printing water-soluble sacrificial molds by fused deposition modeling (FDM) from polyvinyl alcohol (PVA) or digital light processing (DLP) from water-soluble resin."

Source: Institute of Materials and Process Engineering (IMPE)

Applied tutorial for the design and fabrication of biomicrofluidic devices by resin 3D printing

"we present here a concise guide to the principles of resin 3D printing most relevant for fabrication of bioanalytical microfluidic devices. Intended to quickly orient labs that are new to 3D printing, the tutorial includes the results of selected systematic tests to inform resin selection, strategies for design optimization, and improvement of biocompatibility of resin 3D printed bio-microfluidic devices."

Source: Analytica Chimica Acta

Digital Design And Fabrication Of A 3d Concrete Printed Funicular Spatial Structure

"This paper presents a case of manufacturing spatial 3D concrete printed structure using posttensioned technology with multiple force direction. The design of the non-parallel printing path, the joints between single units, and the posttensioned steel cable system in the design and research process are discussed. A funicular spatial structure is built, and a method of manufacturing 3DCP funicular spatial structure is proposed."

Source: Tongji University

the high quality of the final product. this system comprises three innovations applied in the industrial setup, resulting in an efficient and flexible design-to-production workflow."

Source: Designboom

MIT engineers build load-bearing structures using tree forks instead of steel joints

"The system combines generative design and robotic fabrication to allow tree forks – the pieces of wood where a trunk or branch splits into two – to be used as the Y-shaped nodes that connect straight building elements.

Created by the Digital Structures research group at the Massachusetts Institute of Technology (MIT), the five-step approach has already been used to install a demonstration structure on the university's campus, with a larger pavilion now in the works."

Source: dezeen

CONCRETE FABRICATION



Advancing the manufacture of curved concrete

"One of the main advantages of utilising industrial advanced robotic systems in the manufacturing industry lies in the improved security of the supply chain at large, according to The Action Plan for Critical Technologies report from the Australian Critical Technologies Policy Coordination Office (CTPCO). With the amplified demand for implementing advanced robotics within the manufacturing process in many businesses, this has become increasingly evident."

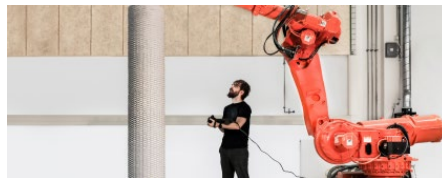
Source: Manufacturer's monthly

Clay 3D printing as a bio-design research tool: development of photosynthetic living building components

"The use of 3D printing is presented in relation to laboratory testing of controlled substrate variables including the impact of ceramic firing temperature, component wall thickness, three types of geometry for exploring cell growth, surface patterns to investigate cell migration, internal chamber subdivisions and clay type. The experiments reveal the benefits and limitations of creating micro-ecologies for algae growth through the introduction of geometry variation. In this study, the natural organismal sensing abilities are explored as a means for cell distribution."

Source: Architectural Science Review

ROBOTIC FABRICATION



A Pedagogy of Digital Materiality: Integrated Design and Robotic Fabrication Projects of the Master of Advanced Studies in Architecture and Digital Fabrication

"This paper illustrates the pedagogical approach to teaching computational design and digital fabrication in the Master of Advanced Studies in Architecture and Digital Fabrication. It demonstrates how the introduction of computational design and digital fabrication methods foster a holistic approach to integrate novel material and constructive systems into the design process."

Source: Architecture, Structures and Construction

DIGITAL FABRICATION



Wood-Veneer-Reinforced Mycelium Composites for Sustainable Building Components

"The paper presents preliminary experiment results showing the effect of veneer reinforcements on increasing bending resistance,

discusses the potential benefits of combining wood veneer and mycelium's distinct material properties, and highlights methods for the design and production of architectural components."

Source: Biomimetics

Poetic and Artistic Aspects of Digital Fabrication in Architecture

"Our aim is not to prove if there is sufficient paper that discuss the artistic aspects of digital fabrication. However this methodology helps us to understand the focus of the papers and the tendencies as an approach in this context. In general, the subject of digital fabrication in architecture is studied more about materials, structures, processes, technology and how to use digital fabrication tools instead of why it was examined in the literature."

Source: Journal of Computational Design

On sustainability and digital fabrication with concrete

"Digital fabrication with concrete has been touted as an avenue to more sustainable construction through more material efficient design, but notably has produced materials with higher carbon footprints and a strong likelihood of reduced durability compared to standard construction. In this short article, a relationship to give a sense of the environmental impact of a structure is introduced, and it is emphasized that shape efficiency is the only unique environmental benefit that digital concrete brings."

Source: Cement and Concrete Research

Mycomerge: Fabrication of Mycelium-Based Natural Fiber Reinforced Composites on a Rattan Framework

"This study aims to showcase mycelium's load-bearing capacities when reinforced with bio-based materials and specifically natural fibers, in an alternative merging design approach. Counteracting the usual fabrication techniques, the proposed design method aims to guide mycelium's growth on a natural rattan framework that serves as a supportive structure for the mycelium substrate and its fiber reinforcement. The rattan skeleton is integrated into the finished composite product, where both components merge, forming a fully biodegradable unit. Using digital form-finding tools, the geometry of a compressive structure is computed."

Source: Biomimetics



Design of an Immersive Human-Centric Cyber-Physical System for Additive Manufacturing

"We developed a novel scan-based method for the real-time monitoring of AM processes. With the incorporation of haptics within the MR system, we demonstrated how I-Interact allows real-time interactions with both digital and physical (deformable/non-deformable) objects simultaneously to streamline the AM process by enabling virtual testing phase prior to the manufacturing phase. We proposed a novel 3D scanning method and implemented this novel strategy to design a customised orthopaedic cast for a human forearm. We also implemented interactions with the deformable objects so that the user can capture the elasticity along with the shape of a physical object to generate and simulate its digital twin."

Source: UCD Theses

Fabricatable axis: an approach for modelling customized fabrication machines

"Digital fabrication tools such as 3D printers, computer-numerically controlled (CNC) milling machines, and laser cutters are becoming increasingly available, ranging from consumer to industrial versions. Recent studies have shown that users, ranging from researchers, to industry professionals, to hobbyists, are interested in modifying and changing the inherit workflows these tools provide."

Source: Software and Systems Modeling

Slabforge: Design Software for Slab-Based Ceramics

"Slab-based ceramics are constructed by rolling out flat sheets of clay, cutting out a pattern, and then folding the cut clay to build a three-dimensional design. Slabforge is an open-source web-based software application that supports slab-based ceramics."

Source: CHI '22: CHI Conference on Human Factors in Computing Systems