DManD

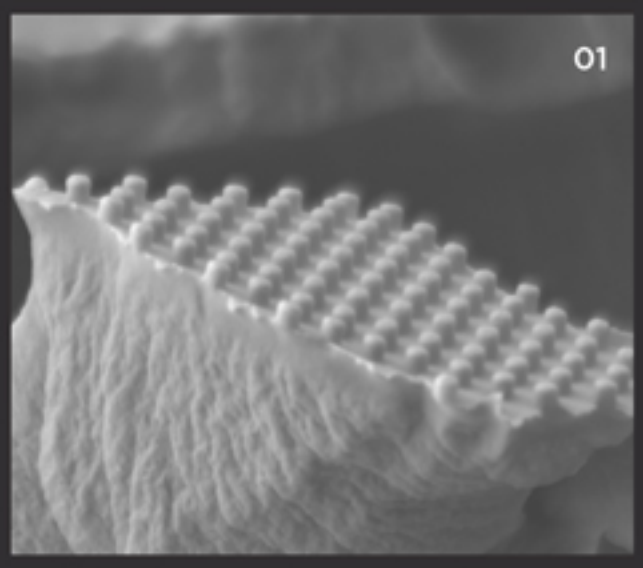
SUTD Digital Manufacturing and Design Centre

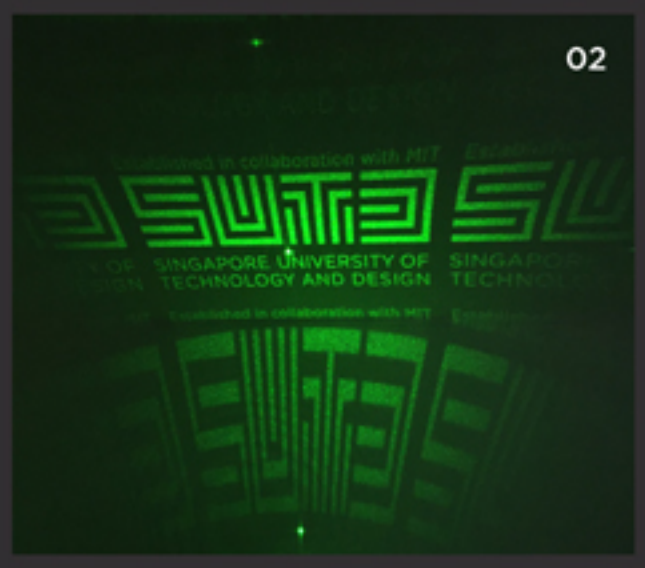
INTRODUCTION

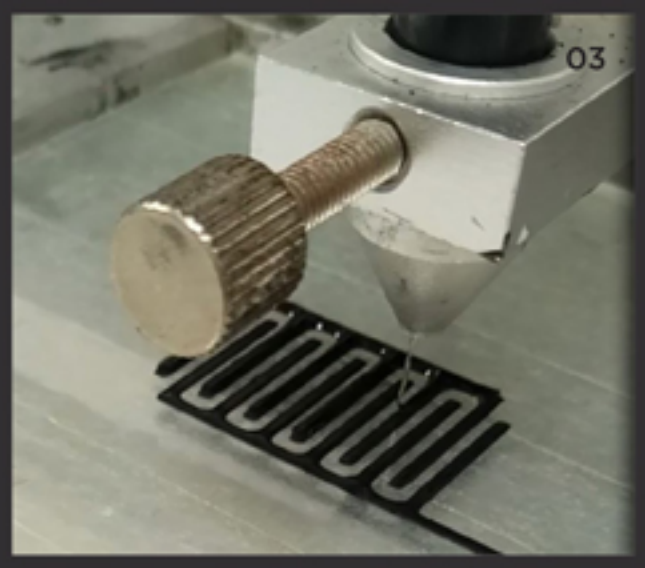
The mission of the SUTD Digital Manufacturing and Design (DManD) Centre is to carry out cutting-edge research that will create the frontiers of digital design and manufacturing.

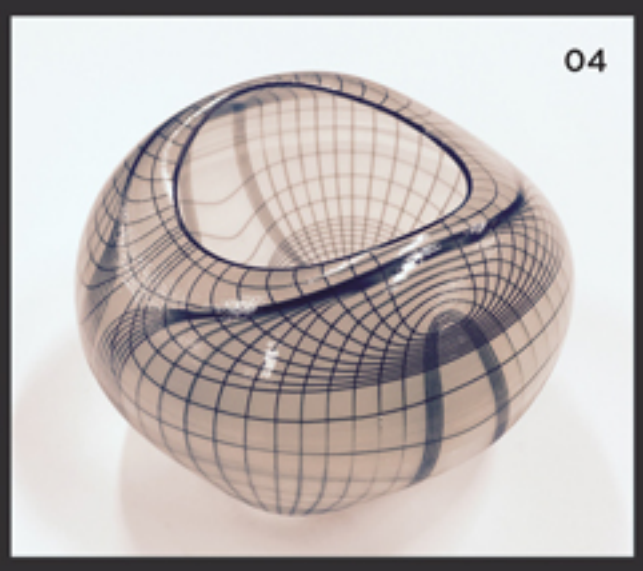
This includes design algorithms, 3D scanning, computer modelling and simulation, 3D printing, robotics, designer materials with complex heterogeneous architecture, novel material and structural architectures.

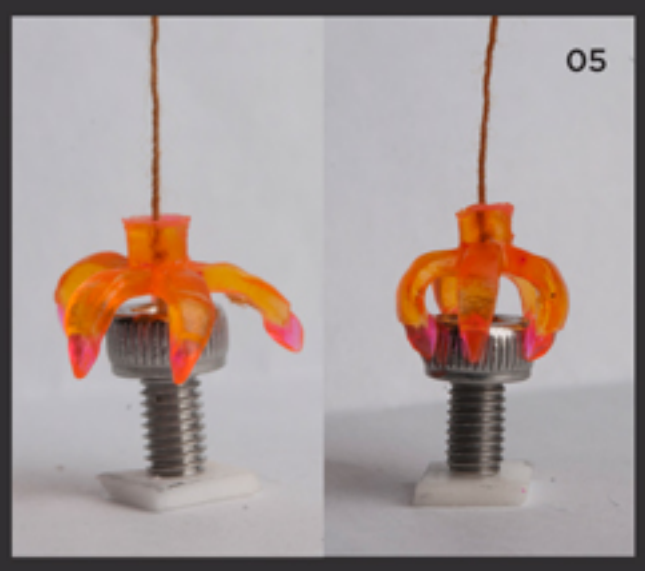
DManD will advance digital manufacturing in a strategic and holistic manner, bringing together modern and emerging technologies (and attendant basic science and engineering) along the digital pathway that will accelerate Ideas-to-Things, and in doing so, create unique, optimal, and previously unobtainable products.

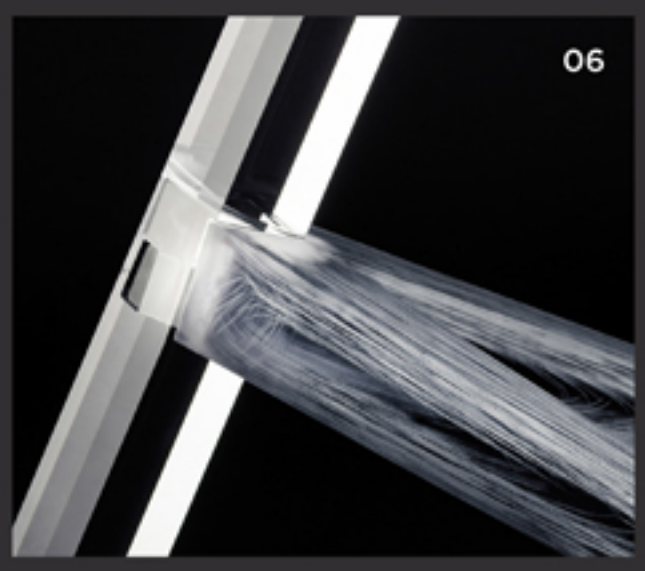


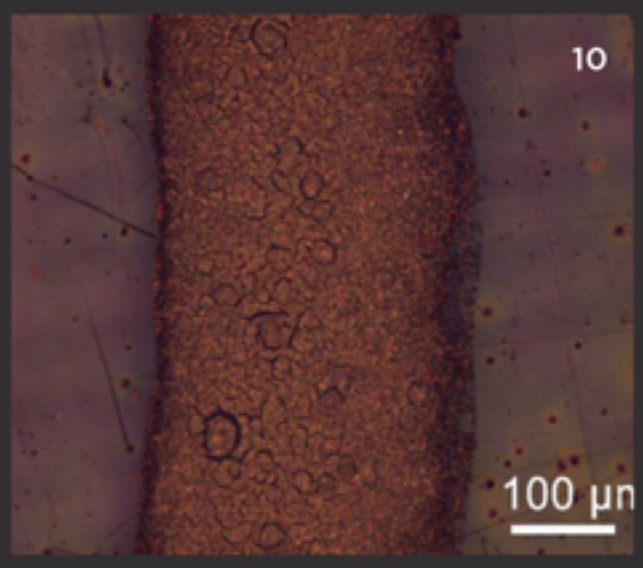


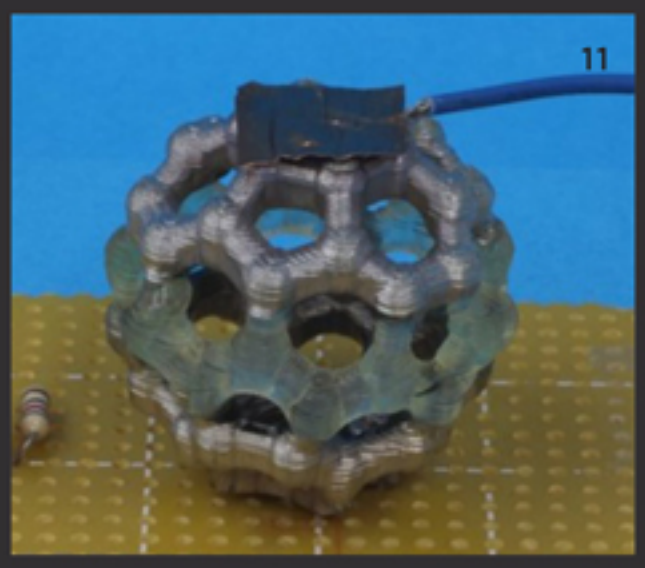




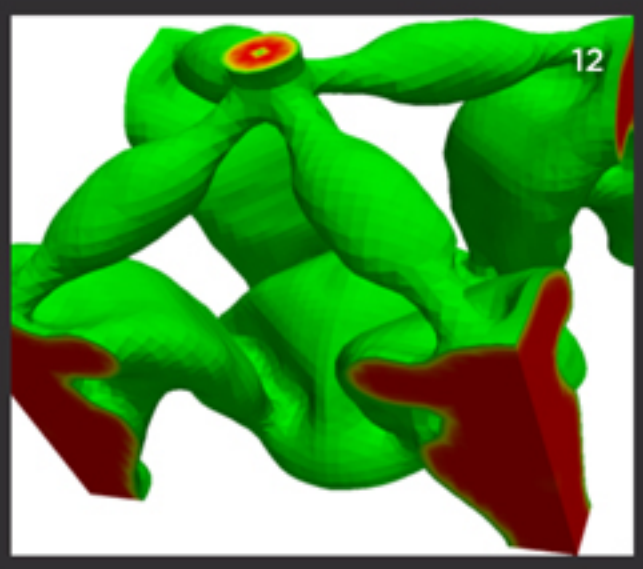






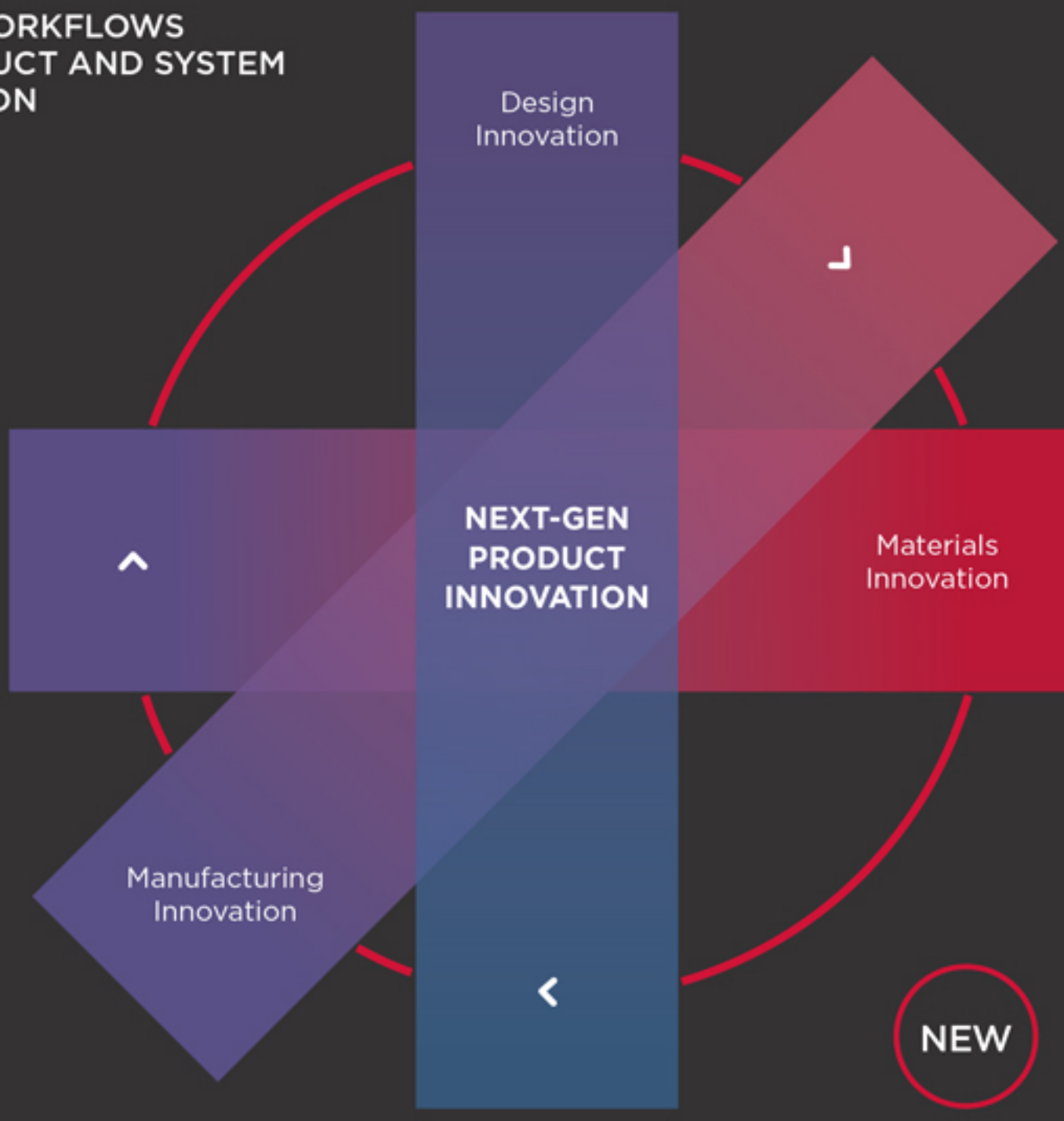


01 3D NANO MOLDING
02 HOLOGRAM OF 3D PRINTED OPTICS
03 3D PRINTED BATTERIES, SENSORS & ELECTRONICS
04 3D PRINTED COMPOSITES
05 4D PRINTING (SMART ACTUATING MATERIALS)
06 COMPOSITIONAL OPTIMISATION
07 METAL 3D PRINTING
08 DIGITISED TEXTURE SURFACES
09 SOFT LATTICE STRUCTURES
10 LOW TEMPERATURE FUNCTIONAL INKS
11 PRINTED ELASTOMER WITH SILVER COATING
12 STRUCTURAL TOPOLOGY OPTIMISATION
13 ZOOMORPHIC DESIGN



APPROACH AND DIFFERENTIATION

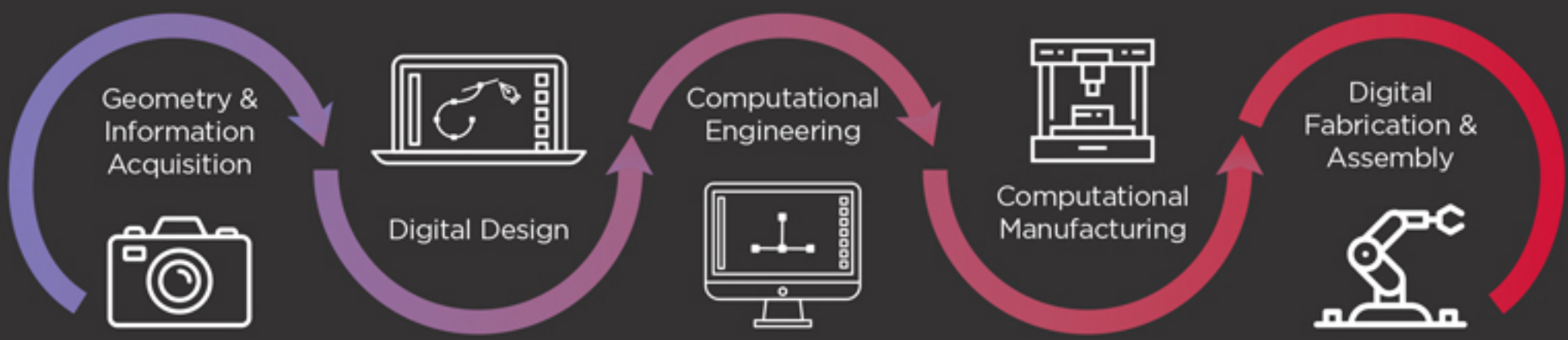
DIGITAL WORKFLOWS
FOR PRODUCT AND SYSTEM
REALISATION



NEW

Convergence of design, materials and manufacturing for innovation

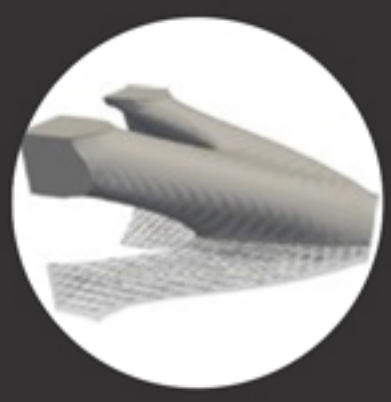
DIGITAL WORKFLOWS TO ACCELERATE PRODUCT REALISATION



GEOMETRY

Space Frame Metal Node

COMPOSITION



3D Printed Composites

PERFORMANCE & FUNCTION

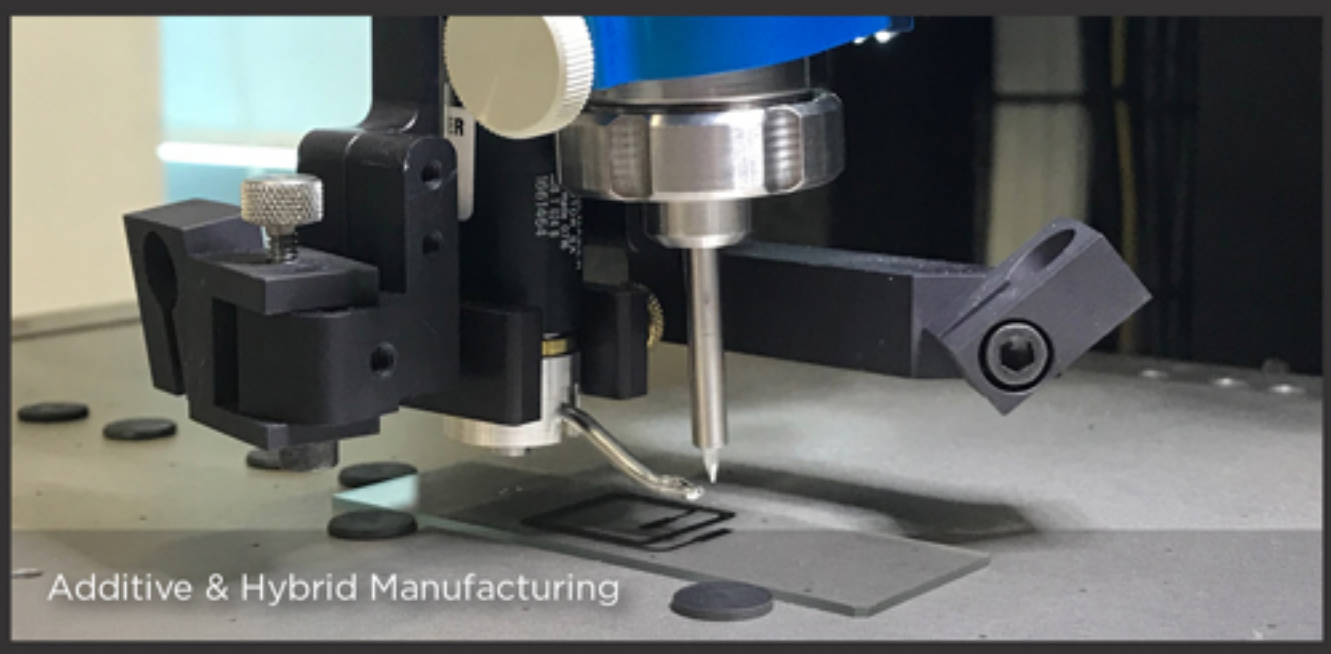
Soft Robot

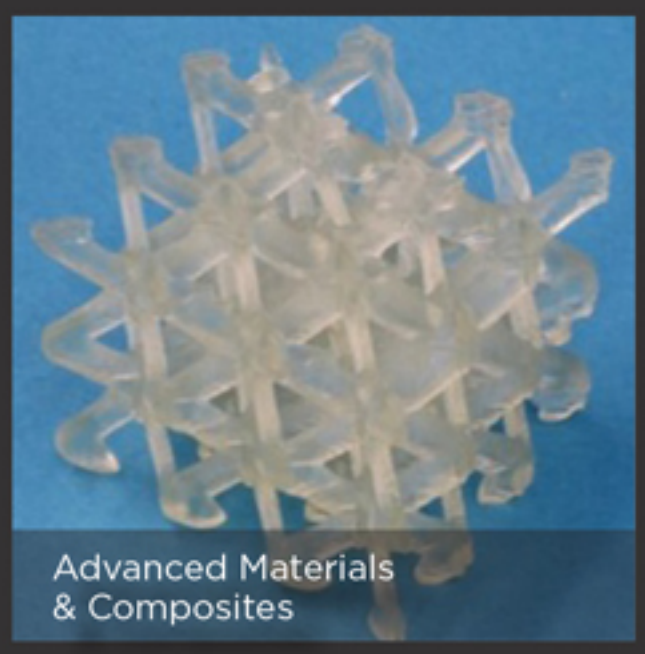
Rocket Fuel

3D Printed Battery

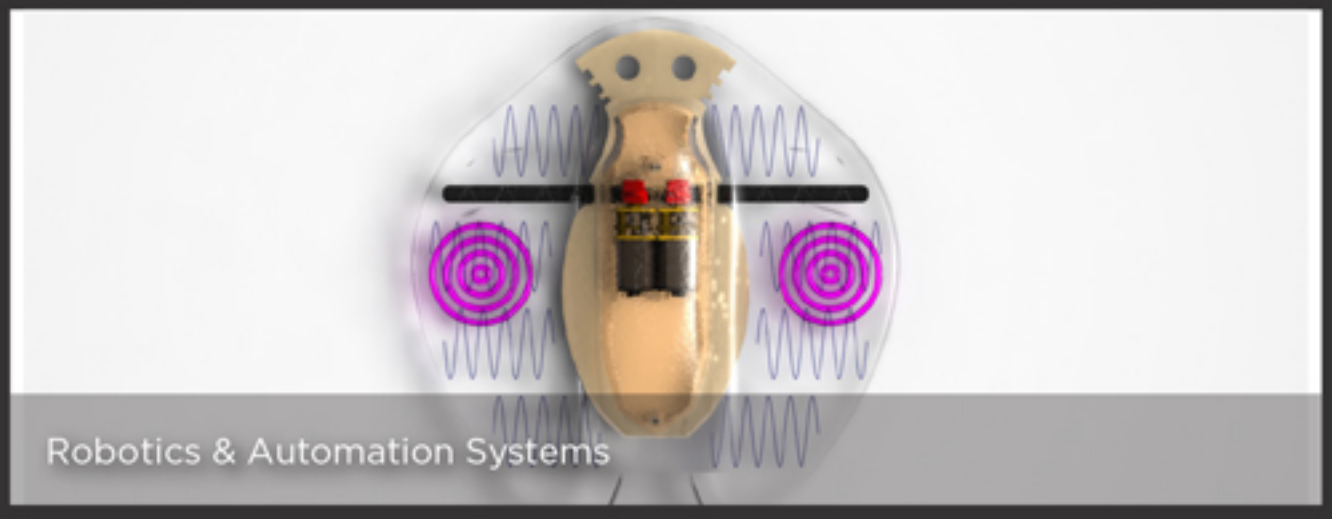
DManD RESEARCH

RESEARCH CAPABILITIES

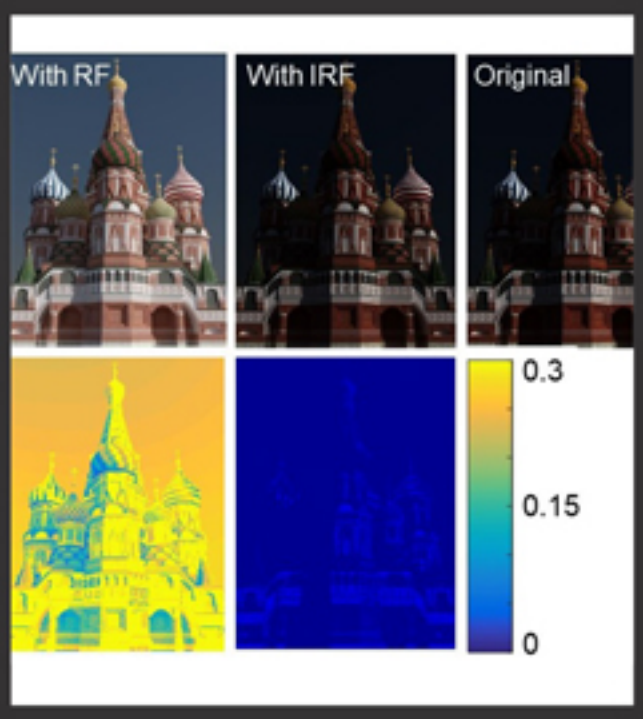

Additive & Hybrid Manufacturing


Advanced Materials
& Composites


Design, Modelling
& Simulation


Robotics & Automation Systems

KEY RESEARCH STRENGTHS



3D SENSING

This research develops novel computational approaches to turn everyday cameras into 3D scanners. This allows 3D models creation without the need for modelling expertise or expensive hardware. We also build different datasets for geometry understanding, algorithms benchmarking and creation of novel reconstruction algorithms.

4D PRINTING

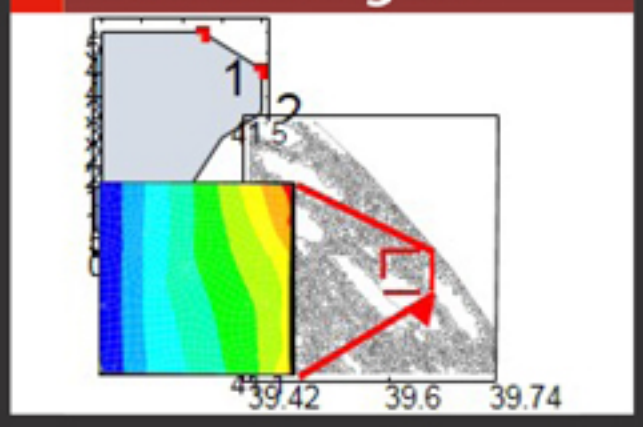
This research aims to realise 3D/4D printing on self-built high-performance multimaterial 3D printing systems based on high-resolution projection micro stereolithography (PμSL) 3D printing technology. This project is focused on developing functional materials which can change shape when triggered and are ultraviolet (UV) curable, thus can be applied to PμSL based 3D printing.

DESIGN AUTOMATION

The research creates data-driven computational design methodologies that integrate the state-of-the-art in multi-physics simulation, integrated topology and shape optimisation, generative design based on high-level design goals, and computer graphics. These design tools are integrated into a complete digital manufacturing workflow, from form-definition to engineering analysis and fabrication of final functional products.

KEY RESEARCH STRENGTHS

Additive Manufacturing Technologies

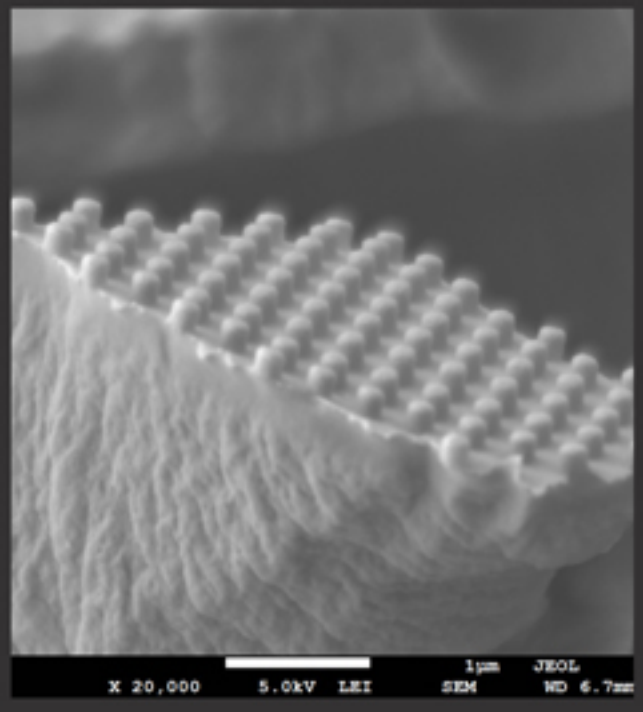


DESIGN FOR ADDITIVE MANUFACTURING

To enable designers to take advantage of the unique capabilities of additive and digital manufacturing, this project will develop a new type of computer-aided design (CAD) system.

Underlying this new CAD system, the key idea is to simultaneously enable the design of the product, its materials, and their manufacturing processes. Problem formulations, geometry+material representations, design synthesis methods, process planning methods, uncertainty modelling, and material characterisation tasks will be performed.

Resulting computational and information models will be integrated into a commercial CAD system to demonstrate design-engineering-manufacturing workflows, novel design capabilities, and new multi-functional device concepts.



NANO-FABRICATION

High resolution nano / micro structured surfaces have become a useful surface engineering method to impart new properties and functions without altering the pristine chemical formulation. The aim of this research is to develop design and manufacturing techniques for high resolution structured surfaces, as well as 3D mold inserts for injection molding processes to achieve high fidelity nano-injection molding of 3D curved objects.

SOFT ROBOTICS & ENGINEERING

The bio-inspired robotics and design research aims to improve the functionality and adaptability of soft robot bodies using advanced multimaterial fabrication.

We develop new additive manufacturing approaches as well as fabrication hubs that enable an efficient workflow from designs to finished components. We combine advanced fabrication, material science, fluid mechanics with bio-inspiration to design and develop novel robots and mechanisms for locomotion, sensing, grasping and manipulation.

TEXTILES & COMPOSITES

3D whole garment knitting enables the fabrication of a new class of technical textiles with complex shapes, advanced materials and functionalities.

We envision that such 3D textiles research allows for functional optimisation not only on the fiber, yarn and textile levels, but also with regard to global geometry, and will thus be suitable for various applications not only in fashion, but also architecture, design, and engineering.

DManD RESEARCH EQUIPMENT

State-of-the-art research facilities in the following areas:

Visit dmand.sutd.edu.sg for a complete list of DManD equipment.

ADDITIVE MANUFACTURING

- EnvisionTEC Digital Light Processor 3D printer
- EOS M280, Direct Metal Laser Sintering
- EOS P 396 Polymer SLS 3D Printer
- HP Multi Jet Fusion
- Markforged Composite Printer
- Optomec Aerosol Jet 5x Electronics Printer
- Stratasys J750 and Objet500 Connex3
- Stratasys Fortus 450MC FDM 3D Printer

ROBOTICS AND AUTOMATION SYSTEMS

- Robotic Printer for Concrete & Natural Composites
- Robotic Welding System

COMPOSITES AND CNC KNITTING SYSTEMS

- Robotic Automated Fiber Placement System
- Shima Seiki CNC Flatbed Knitting Machine

MEASUREMENT AND CHARACTERISATION

- GOM ATOS III Triple Scan
- HIROX KH-8700 3D Digital Microscope
- MTS 50kN Universal Tester

NANOSCALE FABRICATION

- Atomic Layer Deposition System
- Nanonex NX-2000, Full-Wafer Nanoimprinter
- Nanoscribe Photonic Professional GT

NEW MATERIALS DEVELOPMENT

HIGH PERFORMANCE COMPUTING

SINGAPORE UNIVERSITY OF
TECHNOLOGY AND DESIGN

Building 1, Level 7
@ 8 Somapah Road

dmand.sutd.edu.sg

DManD@sutd.edu.sg

sutd_dmand

Photo credit: Jansen Teo Photography

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