<Digital Biomimetics>

Summary

Digital
Biomimetics

Context

Undergraduate
Education

Course

ASD & EPD
Term 7

Date

2019
2020

Developed by

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<Description>
Digital Biomimetics: Sustainable Materials and Manufacturing, is a cross-disciplinary collaboration between Architecture and Sustainable Design and Engineering Product Development. It brings together materials science and digital fabrication, fusing natural composites with industrial robotics, aiming to produce innovation in the realm of sustainable design and manufacturing.

Biomimetics suggest that designs inspired by biological processes found in nature, may assist in transforming society toward a more environmentally benign mode of production from the ground up. This process starts from the understanding of the principles behind structural biological systems and the development of tools embracing the paradigm imposed by nature instead of those predefined by the existing manufacturing technologies.

As a research and design course, students are required to develop their own proposals, methods and artifact which may lead to publication of results in journals and conferences.

<Overview>
Digital Biomimetics is a course offered to approximately 40 undergraduate students, 20 from ASD and 20 from EPD, every year. It is a 7th (BSci) and 9th (MArch) term vertical elective course. The course approaches design thinking bottom-up from the perspective of experimental materials and fabrication design. Digital Biomimetics is a project-based learning module with methodology from architecture, engineering and material science.

<Learning Objectives>
1. Review and analyze (a) the fundamental principles of biological materials and ecological cycles and (b) the design principles of industrial robotics for digital manufacturing. 2. Acquire and apply skills for research work including developing proposals, performing literature review, formulating research questions, collecting evidence, formally presenting results. 3. Design and demonstrate bio-inspired processes integrating materials and fabrication, towards the development of sustainable design of products and processes.

<Measurable Outcomes>
1. Composition of a publication-ready research draft paper that clearly presents the (i) design objectives, (ii) relevant work, (iii) processes and methods used, (iv) prototypes produced, (v) future applications and contributions to the field of bio-inspired design and digital fabrication. 2. Demonstration of a functional proof of concept process and experimental design prototypes evidencing (i) creative and innovative thinking and (ii) integration of technical and aesthetic sophistication competitive with state of the art work in the field.

Student Credits

01 Benjamin Ng
01 Caleb Ng
01 Jishna Bole
01 Mervin Ng
01 Phoebe Phyu
01 Tay Zi Hang

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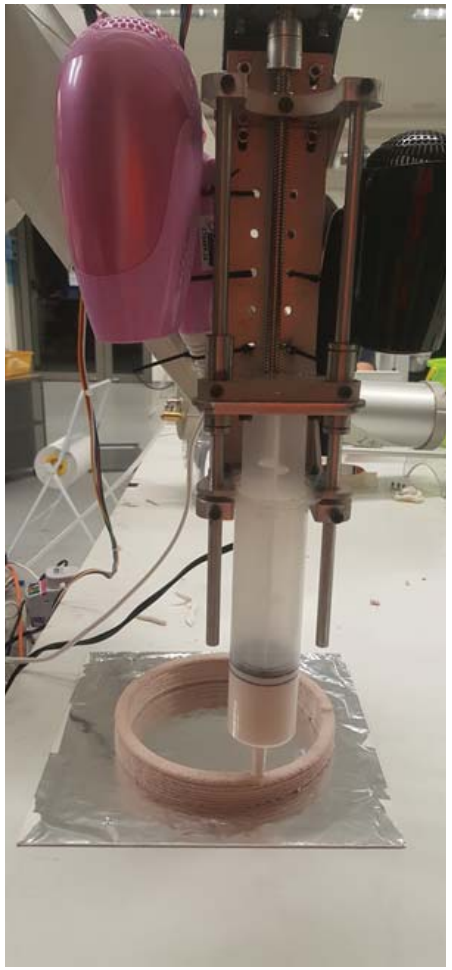

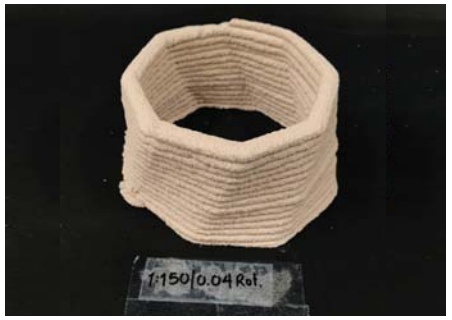

<Materials and Robots>
The first iteration of the course introduced students to biological materials and focused on chitin study. Chitin is one of the most abundant bio-molecule present in the shell of insects and arthropods. It is a natural adhesive binder with structural characteristics. The manufacturing background focused on additive manufacturing via robotic positioning and material extrusion, binder jetting and direct ink writing principles.

The thematic of the initial offer of the course targeted the subject of urban waste. Organic urban waste is one of the most rapidly rising segment of refuse production in cities around the world and one that is most difficult to reclaim. It is a major environmental challenges which is bound to be amplified as the world population is moving towards living in ever more populated cities.

Students were motivated to consider waste valorization strategies, manufacturing with material byproducts and design artifacts based on urban waste. In this sense the course aimed at approaching circular models of production and consumption.

Student Credits

01 Lim Jie Hong
01 Loo Jun Wen
01 Quek Wen Jia
01 Ryan Teo
01 Jun Yan
01 Tan Hui Yin

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01	01