

Transformational Intelligent Systems

Parametric Simulation Workshop Proposal

“Kinetic systems with embedded intelligence will expose new programmes and forms as this technology is incorporated into our everyday lives.”¹

Keywords: Grasshopper, digital simulation, self assembly, muscle wires, responsive components, kinetic architectural systems.

Topic: Design, Simulation & Evaluation.

Introduction

Contemporary design methods and processes are shaped by the tools and industry related topics such as materiality, mechanics and organic assembly. These factors influence, if not determine, not just the way the final product is achieved, but also how we think about our emotional attachment to products themselves.

In that framework, our proposal is that if we can develop integrated design, simulation as a means to preview fabrication, not only can we achieve a more fluid road between ideas and component/products, but also upgrade its potential influence in the public through an adaptability that can be far more customizable than anything we've done or even imagined before. In this mindset, intelligent kinetic systems are at the forefront regarding intelligence embedded, dynamic systems.

Material behavior simulation (specifically Shape Memory Alloys or SMA, in this case Ti-Ni) could shape the decision making processes in design and pose specific kinetic challenges that arise from bridging the gap between those two workflow processes (design and fabrication). Our workshop intends to propose a very specific kinetic design application, to define an architectural component and to build simulation models that anticipate the application's physical behavior traits.

Workshop presenters

- **Effimia Giannopoulou** (Thessaloniki-Greece). efeminno@faberarium.org
Member of the Technical Chamber of Greece and founder of “Faberarium Workshop: Fabrication Technologies for Architecture”, a Research and Design company based in Europe, since 2012. Holds a M.Sc in Biodigital Architecture from the ESARQ, International University of Catalonia (2009). With an artistic background, her basic fields of interest include trans/interdisciplinary research and industry collaboration. She is dedicated to writing and teaching workshops in Europe and South America, in order to connect the relevance of biological processes with architecture by computational means of design and advanced technologies for digital fabrication and construction.
- **Nelson Montás** (Santo Domingo, Dominican Republic) arq. montas@gmail.com Holds

¹ Fox, Michael, *Sustainable Applications of Intelligent Kinetic Systems*, Kinetic Design Group, Massachusetts Institute of Technology, Department of Architecture, 2001 (<http://profamateus.no.sapo.pt/mitharvard2.pdf>) (06-02-2014) P. 4

an architecture degree from the Universidad Nacional Pedro Henríquez Ureña's School of Architecture and Urbanism (2006) in Santo Domingo, Dominican Republic, where he is a registered architect (CODIA 25715) and has practiced the profession since. He also holds a Master of Science in Biodigital Architecture from the ESARQ at the International University of Catalonia (2009) where he also recently fulfilled requirements for Ph.D. accreditation. He is also a visiting researcher at the Ecole Nationale Supérieure d'Architecture Paris - La Villette where he is carrying out research on Shape Memory Materials simulations using parametric tools, under the guidance François Guéna, Ph.D. As a freelance architect with a civil engineering background, he has been a designer, evaluator and construction supervisor at the Potable Water and Sewage Systems Institute in the Dominican Republic. He has also been involved in teaching, namely at the Pontificia Universidad Católica Madre y Maestra's School of Architecture and is currently involved in active research.

- **Pablo Baquero** (Bogotá-Colombia). paniba@faberarium.org
Holds an Architecture Ph.D. from the ESARQ and a Master of Science in Advanced Architectural Design, Columbia University. He studied American Architecture at Cooper Union and Performing Arts at New York University, Bachelor of Architecture U.P.C. Bogota.
He has been co-teaching (Pratt Institute with Peter Macapia and Parsons University with Andrew Macnair) and invited to participate in final reviews as critic at GSAPP, Columbia University, Pratt Institute and Parsons University. He has worked with Frank Repas Architecture in Advanced Modeling and Emerging Systems Research. In Barcelona, he has co-taught and participated in final reviews at Elisava, ESARQ and IED. He has co-organized various seminars/workshops around Europe and South America related to computation, biology and digital fabrication. Furthermore, he is involved in different research projects with Karl Chu and Alberto Estevez. Currently, has been guest researcher in TU Delft, Hyperbody group and founder of "Faberarium Workshop: Fabrication Technologies for Architecture", a Research and Design company based in Europe, since 2012.

Number of participants: 15 students.

Previous knowledge of the participants: Participants should be familiar with Grasshopper.

Required Infrastructure of the participants: Laptop, Rhino and Grasshopper, Kangaroo.

Required Infrastructure of the organizers: Projector.

Timetable:

Monday, 22nd August 2016

One day workshop.

“ SMM Material Behavior Simulations”. Introduction to Material behavior simulation by Nelson Montás.

Parametric Modeling and Simulation. Rhino/Grasshopper and plug-ins will be the main platform for modeling, and Kangaroo will be used to simulate and evaluate outcomes of the possible changes in the kinetic structure.

Case Study and envisioned Outcome:

The experiment will consist of the design, modeling, and subsequent simulations of a kinetic system built upon a combination of self organizing SMA and other materials to fit specific building application criteria and standards. One of the objectives is to design a dynamic kinetic structure and to simulate the material's behavior in order to properly predict critical function, actuation and physical properties. Grasshopper + Kangaroo bridge the design-simulation tool's workflow in a single stream to optimize and protocolize a smoother and fluent decision making process.

(We are open to discussion about the possibility building a prototype.)

Examples of previous workshops/projects:

<http://re.hyperbody.nl/index.php/Msc2workshop:workshop07>

<http://www.faberarium.org>

<https://vimeo.com/51372799>

References:

<http://makezine.com/2012/01/31/skill-builder-working-with-shape-memory-alloy/>

<http://vanguarq.wordpress.com/2009/06/25/kinetic-architecture/>

<http://vimeo.com/39444380>

<http://icd.uni-stuttgart.de/?p=9869>

https://www.youtube.com/watch?v=W7_LFXz2Z38

<https://www.youtube.com/watch?v=fPXr0HEwoD8>