

CoOptimise

- a workshop that explores human and machine's cooperation in optimisation and design.

By Kristjan Nielsen, Engineer at Arup and Mariam Khademi, Student at Sapienza University of Rome

ABOUT THIS WORKSHOP

Architecture and engineering have always been inseparable. It is not possible to imagine one working without the other. 2000 years ago, Vitruvius wrote down what had already been acknowledged for ages; architecture is **function, stability and beauty**. Standardisation and mass-production methods of the second industrial revolution created a gap between architects and engineers that we are still trying to bridge today. With the so-called third industrial revolution – the **digital revolution** – we now have the opportunity to revert our design traditions and to create holistic solutions for a sustainable future.

WORKSHOP OBJECTIVES

This workshop will provide designers of tomorrow tools to **analyse and optimise** structural schemes on a conceptual level. We will use the dynamic and scriptable interface of Rhino/Grasshopper with the **structural analysis** plugin Karamba. With dynamic geometry in Grasshopper, optimisation is made straightforward and the designer no longer needs to set up geometry, loads and supports for each separate model he or she wants to run. It is **automated**. With Karamba the designer has a FEM solver at hand that is built into the dynamic environment of Grasshopper. The ability to numerically test all your options calls for an optimisation to take place. The most fit option can be found, whether that being the most functional, the most stable or the most beautiful one.

OUTCOME

We finish the workshop with **building and testing** a series of designs, to compare digital simulation with real life results.

BIOGRAPHIES

Kristjan Nielsen is a Danish structural engineer with international experience from Paris, London and Berlin. He's applied computational design methods for various scaled projects, from small art pieces and pavilions to world cup stadia and high-rise towers. Since 2012 Kristjan has been running workshops on computational design at conferences as Smart Geometry '14 in Hong Kong and Design Modelling Symposium Copenhagen in 2015, as well as at École nationale supérieure d'architecture Paris-Malaquais in Paris, La Sapienza University in Rome, Technical University of Denmark in Copenhagen, Ecole nationale supérieure d'architecture de Versailles in Versailles and at Contemporary Architects Association in Tehran, Iran.

Mariam Khademi is currently studying Building Engineering and Architecture at the faculty of Civil and Industrial Engineering at Sapienza University of Rome and holds a Bachelor's degree in Cell and Molecular Biology from The University of Tehran. Together with Kristjan she has organised two one-day workshops at the faculty of engineering at Sapienza University of Rome, as well as a workshop at Contemporary Architects Association in Tehran, Iran.

SIZE

The workshop will run for two days, split between $\frac{2}{3}$ lectures, tutorials and exercises on the computer, and $\frac{1}{3}$ model making.

TENTATIVE PROGRAM

Day 1

Part one: introduction to FEM analysis using state-of-the-art FEM program Karamba.

Part two: students will learn how to assemble their own structural models using Karamba.

Day 2

Part one: students will be divided into groups and will design their own structure and make small scale models.

Part two: groups will have found their preferred design which will be further developed, fabricated and tested.

PREREQUISITE SKILLS OF PARTICIPANTS

Basic modelling skills in Rhino and grasshopper are required although no specific knowledge of Karamba is needed. Students should bring their own laptops with Rhino (eventually trial version) and Grasshopper installed prior to the workshop. A group license for Karamba will be provided to participants.

LOGISTIC AND TECHNICAL REQUIREMENTS

A room with a projector and desks for the number of students is required. This workshop requires tools for production of scale models and load tests. Preferably laser cutter with wood or cardboard. We suggest that this will be determined in collaboration with the conference organisers.

MAXIMUM NUMBER OF PARTICIPANTS

This workshop can accommodate 10-15 people.

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