Form-Adapt

Using Adaptable Form-work for Fabricating Double-Curved Surfaces

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This workshop will introduce the use of FlexiMold, an adaptable form-work device for fabricating double-curved surfaces; and Marionette, the parametric design tool of Vectorworks. The participants will have the opportunity to experience the entire workflow from the design to the production of a spatial object which has a complex form. The object will be composed of separate panels each of which will be designed by a participant and will be fabricated by team work.

Keywords: *Computational Design, Computer Aided Manufacturing, Double-Curved Surfaces*

OBJECTIVES

The aim of this workshop is to introduce the participants a hands-on approach for fabricating double-curved surfaces by using an adaptable form-work system and computational design methods. This workshop is a follow up of a series of workshops which have been organized by the Chair of Design Informatics (see Url [1]) of TU Delft.

The concept of adaptable form-work (or; flexible formwork, flexible mold) refers to a range of fabrication devices which can be reshaped and reused to produce objects in different forms. With the help of these devices, it becomes possible to produce different objects by using a single mold instead of producing a different mold for each object. Various concepts of reusable flexible molds already exist. One of the early examples was developed by Piano (1969) when aiming to construct shell structures using a flexible mold system. Designs of flexible molds which are closely related to our workshop are developed by Kosche (1999) and later by Rietbergen and Vollers (2008). Except these ones, there are a number of related patents of which an extensive overview is given by Schipper (2015), whose works focus on the use of flexible molds for producing concrete elements. There also exist three similar flexible molds which are used for large scale production in industrial applications. The first one is the one which is is developed by Adapa (see Url[2]). Another similar system is used by Curve Works (see Url[3]) Also, the concrete factory mbX (see Url[4]) has developed its own system which is used to produce the double curved roof panels of Arnhem Central station.

The content of this workshop is based on the workflow and the objectives which were presented by Aşut and Meijer (2016). The idea here is to allow the participants to comprehend the basic notions of Computer Numeric Control (CNC) through a hands-on experience. The adaptable form-work in this content is hypothetically defined as an HNC (Hu-

man Numer Control) medium which enablesdirect and organic interaction with numeric information. Therefore, it is proposed as an efficient instrument which triggers active learning in this field. Moreover, its potentials towards fabricating complex forms are addressed through challenging design assignments. These assignments require the use of computational design techniques for both generating design solutions and deriving the fabrication information.

PROCESS

In this workshop, unlike the previous ones, we are going to use Marionette (see Url [5]), the parametric design tool of Vectorworks (see Url [6]) for computational design. The students will be briefly introduced to the software and they will use it to customize a parametric model which will be provided by the workshop coordinators. The model which will be given by the workshop coordinators will serve as a basis for the design assignment. It constrains the design solutions towards a number of geometric parameters to ensure a successful fabrication. The participants will work on this model individually and they will generate design variations. This will provide them an opportunity to get familiar with the software and to gain an understanding of its capabilities.

After discussing the design solutions which are generated by the participants, we will form two teams (team size depends on the number of participants) to collaborate for the fabrication of designs. Our aim is to fabricate a design from each participant. However, we are limited by time and realization of this aim depends on the number of participants and how fast do they work. In this phase, the participants will first use the computational model to understand and analyze the forms which they have designed. They will derive the information sets which are required for the fabrication.

In the following phase, the participants will be introduced to the fabrication workflow. They will learn how to reshape the form-work for each panel by using the information which is derived from the parametric model. By working in teams, they will fabricate the designs. Eventually, all panels will be assembled to constitute a whole object which will be exhibited during the conference.

EXPECTED OUTCOMES

The expected outcomes of this workshop are as follows;

- Basic understanding in computational design
- Basic understanding in computer aided manufacturing
- Basic understanding on the geometric principles double-curved surfaces
- Fundamental skills in using Marionette
- An actual scale spatial object which has a complex form

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