MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING | LUND UNIVERSITY

MATTIAS LILJA

PRESENTATION
Spring 2016

REPORT
Will be published as
Report TVSM-5209

SUPERVISORS
DANIEL ÅKESSON *MSc*
Div. of Structural Mechanics, LTH

EXAMINER
JONAS LINDEMANN *PhD*
Div. of Structural Mechanics, LTH & LUNARC

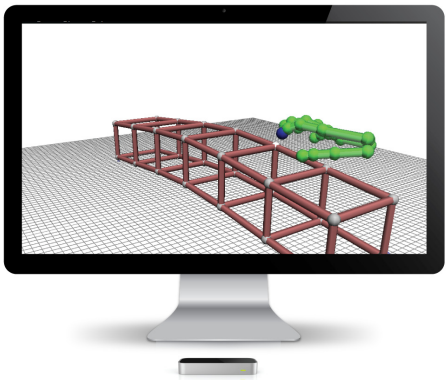
THE WORK IS PERFORMED AT
DIVISION OF STRUCTURAL MECHANICS

AUGMENTED REALITY FOR STRUCTURAL CONCEPTUAL DESIGN

The earliest phase of the design process is referred to as the conceptual design phase; the decisions made in this phase have the highest impact of the decisions made throughout the design process, simultaneously the importance of the conceptual design phase is often overlooked and structural aspects are often only considered in a late design stage [1]. A contributing factor to this is that very few computational tools are available for conceptual design. The challenge with developing such computational tools is the fuzzy nature of the problem, knowledge and constraints are imprecise and incomplete. Conventional advanced structural analysis software requires precise knowledge of the problem and insufficiently agile to follow a designer's iterative workflow, and premature use of such software can negatively affect the quality of the conceptual design [2].

Which design tool is used to generate and represent ideas also affect the quality and quantity of early prototypes, where quantity is measured as the number of prototypes that are generated. In [3] it was shown that physical prototypes generated a higher quantity of prototypes which also were perceived as more novel compared to using CAD or sketches. The prototypes that were perceived as more novel also tended for fare poorly on all other measureable qualities.

The present work aim to create an augmented reality where the designer can create and interact with a digital prototype. Using a digital prototype enables real-time feedback of structural performance - and also real-time guidance, where other well performing design alternatives can be presented. A further possibility with augmented reality is that the prototype, in this case the structure, can be visualised in the intended context.



The game engine Unity3D will be used for this project, with the implementation in C#. Unity has full support for the 3D input controller "Leap Motion" and the virtual reality glasses "Oculus Rift". The project seeks to further develop previous work [4] that has been carried out in the department.

[1] M. Schlaich, "Challenges in Education–Conceptual and Structural Design," 2006, 31st ed., vol. 92, pp. 20–26.

[2] M. Fröderberg and R. Crocetti, "Engineers in need of an improved conceptual design toolbox," 2014, 37th ed., vol. 102, pp. 515–521.

[3] A. Häggman, G. Tsai, C. Elsen, T. Honda, and M. C. Yang, "Connections Between the Design Tool, Design Attributes, and User Preferences in Early Stage Design," J. Mech. Des., vol. 137, no. 7, p. 71408, 2015.

[4] D. Åkesson and J. Lindemann, "Using 3D gesture controls for interacting with mechanical models," in World Congress on Computational Mechanics (WCCM XI).

DIVISION OF STRUCTURAL MECHANICS
Lund University, Faculty of Engineering (LTH), Box 118, SE-221 00 Lund, Sweden
• Tel: + 46 (0)46-222 73 70 • Fax: + 46 (0)46-222 44 20 • www.byggmek.lth.se

xpTVSM-5209 (2015-10)