

ARCH 465 | Contemporary Architecture and Theory
2021-2022 Spring Term | Lecture Report

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Report 6 | Digital Architecture

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INTRODUCTION

This report will investigate the sixth lecture of the ARCH465: Contemporary Architecture and Theory course. This lecture begins by explaining the “Architecture of the Digital” understanding with several examples that shows the impact of digital tools onto architecture and the process of form-finding. One of the essential parts of is lecture was to emphasize on that the term digital architecture is not a style; it is a way of expression, understanding. Digital architecture means designing a project that uses the tool of digital computation in

terms of precise presentation on how a complex, intricate structure looks like, its optimization, fabrication, and so on. The lecture moves onto the historical layout of digital architecture and how it has traces that go back to Baroque in curvilinearity, and the roots of forms that were dreamt of in German Expressionism yet couldn't have managed to be drawn due to the lack of digital tools to design it. It includes the Lynn's 4 key concepts that he stated as essential for conceptualizing the main futures of digital architecture such as: Curvilinearity, Folding, Intricacy,

Smoothness, and the explanations of these principles. The lecture also mentions how the digital enables architects to use structural computations on their designs.

The aim of this report is to investigate the matter in two branches: smoothness and intricacy of the form, and the computational benefits that digital architecture facilitates to its users by several examples.

DIGITAL ARCHITECTURE AND SMOOTHNESS IN DESIGN

Architecture, it is not fully about neo-modernism and functionalism anymore. The

characteristic of Digital Architecture is to “be able to do”. Being able to dream, reflect, and present. The skills and tools that give access to designers to construct their visions in a digital medium. The codes, parametrics, and technologies. The curvilinearity, the infinite continuity of the surface and the form. These are all what is inspiring and revolutionary in this lecture. There is no “ideal” housing units or masterplans anymore; what’s essential is the concept of reflecting structures on digital design that seems quite hard to show on paper before.

This particular type of understanding is a common example. In

contrast with the ideals of modern architecture, it is almost impossible to see the exact same form in a different place because in its form-finding process, the environment, the purposes and functions and other elements are all considered as a differentiating parameter in these curvilinear and smooth structures. This is a photo of a project by the UN Studio in 2015 called the Arnhem Central Masterplan. The space in the photo is the transition from the train station, and these smooth continuity of materials from the floor to the ceiling resembles the concept of transition from a space to another in an expressive manner.

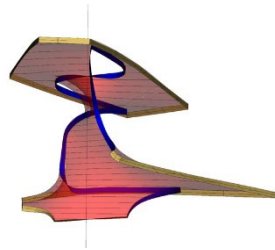
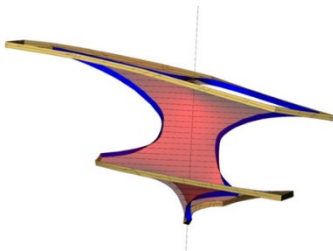
The aim in this project is to produce continuous flexible system that integrates the different surfaces.

“‘The twist’ unifies the whole confluence of different modes of transportation coming together into an exhilarating celebration of movement, shot through with light.”

Aaron Betsky,
ARCHITECT
Magazine
Online, 2016

The design process of this large free-form sculptural element needed to have a digital design basis since it would have

been quite inefficient to draw the whole structure by manual drawings that only uses a pencil and a T-square. In this sense, the synthesis of the analog and manual methods starts to come handy in order to have a good idea from the drawings. Thus, the studio constructed this design by transforming their hand sketches onto digital mediums and started playing with the parameters of Grasshopper, Rhinoceros.

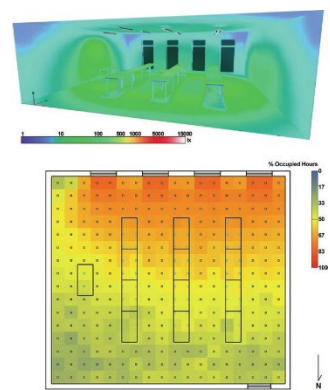


DIGITAL ANALYSIS IN DESIGN

Although the things that people can do with digital tools in terms of designing forms are quite inspiring, one other thing that digital architecture enabled is the static and environmental computations that designers can proceed to optimize their projects with. Therefore, the optimization process of designs also depends on computational

techniques rather than only constructing explorational forms.

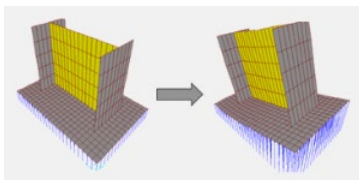
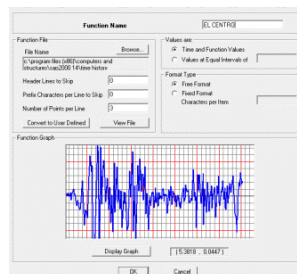
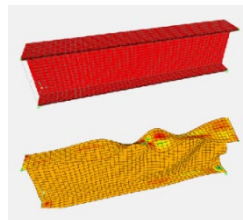
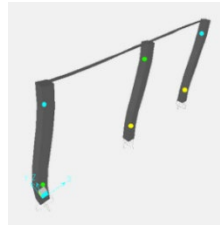
One interesting software might be DIALux that helps architects with their lighting computation and overall analysis on average energy usage on lighting and its optimization. This software calculates and visualize light for indoor and outdoor areas with inserting the properties of real lighting products. This software is a great example on how digital architecture facilitated to analysis ad implementations on design can be optimized by the help of computers and software.



Options	Lamp type	Power density (W/m²)	Average illuminance (lx)	Uniformity (L/L)	Control type	Annual electric consumption (kWh/m²·year)
Tabulated value	–	12.0	–	–	–	18.91
1	TL5 38W x 4	11.2	531	0.96	Manual on/off switch	7.36
2	LED 41W x 3	9.1	523	0.96	Switch Off with Occupancy	4.10
3	LED 47.5W x 2	7.04	512	0.94	Dimming with Occupancy Off Sensor	2.49

Another software worth-mentioning might be SAP2000. It’s a software that help architects and engineers analysed calculate structural strengths and properties of their designs. For earthquake simulation, both static and dynamic approaches, ad nonlinear-static-pushover analyses

can take into account modal, uniform, or user-defined lateral load patterns, slender element plastic-hinging behaviours, inelastic response of shear walls, floor slabs, and steel plates, and then calculate demand-capacity, damping, and performance-point calculations with customizable summary reports. Also, response-spectrum, power-spectral-density and steady-state, and time-history analyses are some of the dynamic methods available.



CONCLUSION

To sum up, there are many understanding on digital design that results in different shapes and purposes. Some like to elaborate on how forms

can be generated by different lines of codes; and some like to explore the most optimal way to design a house that ensures healthy sunlight within its position of construction. The silver lining is that digital tools

brought a whole new way of thinking that helps architects produce their vision onto drawings and calculations that was quite hard to do in previous eras.

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REFERENCES

Jencks, C. (2013). *Nonlinear Architecture* (1997). *The Digital Turn in Architecture 1992–2012*, 80-107.

Arnhem Central Masterplan. (2022). UNStudio. <https://www.unstudio.com/en/page/12109>

de Luca, F., Simson, R., Voll, H., & Kurnitski, J. (2020). Electric Lighting Predictions in the Energy Calculation Methods. *Springer Proceedings in Energy*, 123–141.

GmbH, D. (2022, March 3). *DIALux - DIAL*. DIALUX. <https://www.dial.de/en/dialux/>

Home - SAP2000 - Computers and Structures, Inc. - Technical Knowledge Base. (2022). SAP2000. <https://wiki.csiamerica.com/display/sap2000/Home#Home-Analysis>

Structural Design and Analysis. (2017, April 5). *Static*. <https://structures.aero/software/nx-nastran/static/>