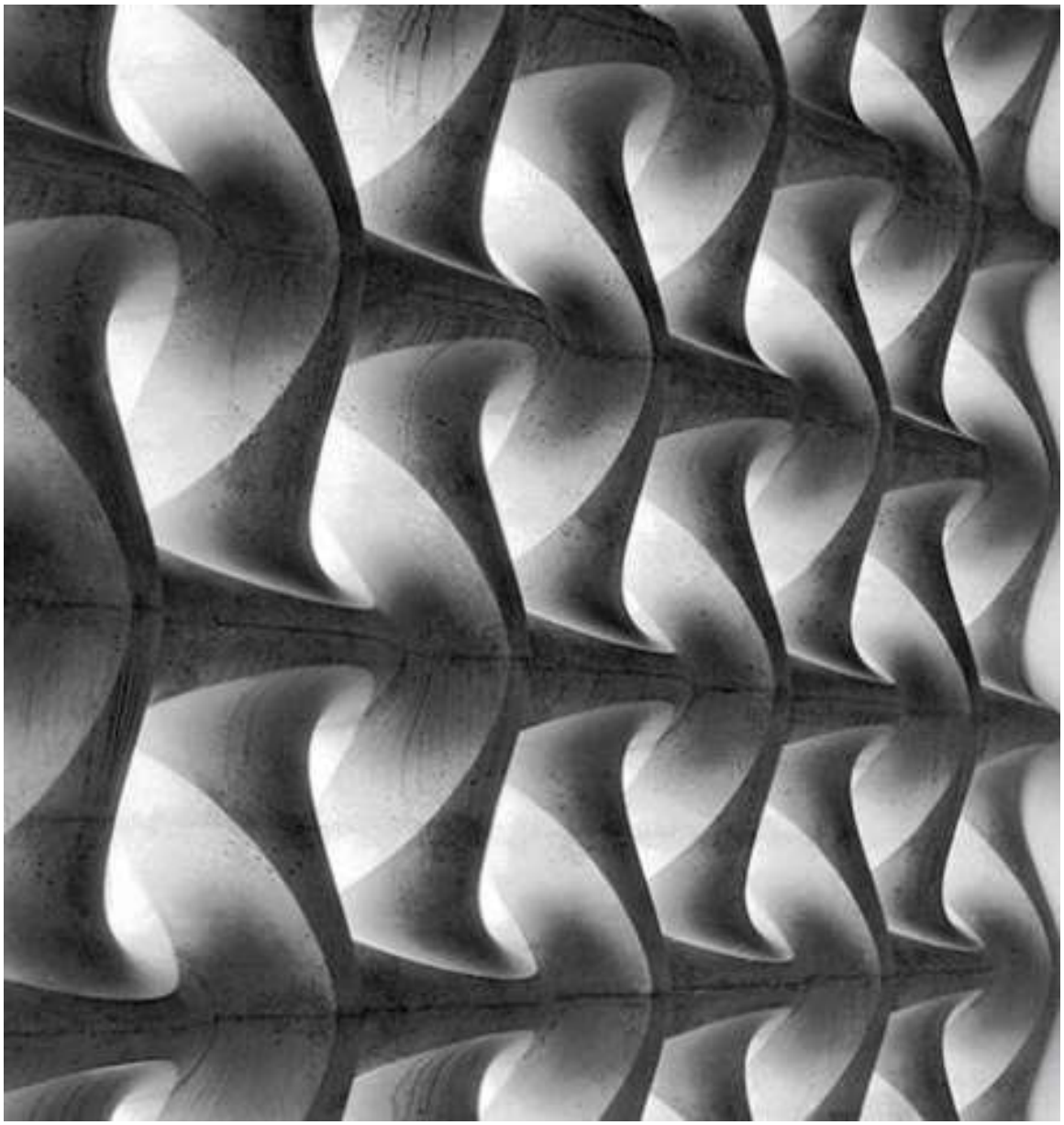
ESCOLA POLITÉCNICA DA USP
Programa de Pós-Graduação
ENGENHARIA CIVIL

Cátedra Construindo o Amanhã – ArcelorMittal



Graduate Course
Performative Porosity -
Volumetric Modelling for Building Envelopes

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Background

Facing a dramatically increasing urbanization worldwide and our limited resources, we need to find new ways to design and fabricate buildings more sustainable. The digitalization of architecture, engineering, and construction can play a key role here. Specifically, new fabrication methods such as 3D printing allow materializing building elements in an unseen level of detail and using the material more efficiently. But as architects and engineers, we need new design tools to fully harvest this potential. Therefore, volumetric modelling (VM) is of special interest. This design method defines shapes implicitly by continuous functions instead of by their explicit boundaries only.

Objective

Building envelopes are highly relevant to the energy balance of a building. The goal of the course is to develop performative façade elements, by using computational design and considering the possibilities of digital fabrication. Many historical examples demonstrate how “smart geometry” can control building physics (e.g. cooling chimneys, screens, louvers). The “opening" plays an important role in architectural design. While a classic window is only one type of opening, other types of perforations and porosities bear a rich potential to integrate a multitude of functional aspects. In this course, we don’t want to regard façades as a flat element, but instead design it as a fully three-dimensional element with depth, inner structure and controlled porosity – forms which can only be fabricated with 3D printing. Therefore, we will use volumetric modelling in the design process.

Requirements

- Basic knowledge in CAD modelling required.
- Own computer with Rhino, Grasshopper, and Axolotl

Students are recommended to check literature and familiarize themselves with the software before the course starts. Evaluation software is available at https://www.rhino3d.com/download .

Schedule

1st Module 2019			
Seq	**Date**		**Content**
1	11/11	9 – 12h	● Lecture: 3D Printing in Architecture ● *Workshop*: principles of volumetric modeling, 2d examples, introduction to assignment
2	11/11	14-17 h	● Task for the week: 3D printed Smart Brick, functional integration ● Rhino, Grasshopper, Axolotl, basic tutorials
3	12/11	9 – 12 h	● Lecture: Computational Design ● *Workshop*: Axolotl, advanced tutorials
4	12/11	14-17 h	● Discussion of project ideas
	13/11	9 – 12 h	Public Seminar
5	14/11	9 – 12 h	*Workshop*: COMPAS core, compas_vol
6	14/11	14 - 17 h	● advanced tutorials, solar analysis
7	18/11	9 – 1 2h	● Presentation of 3D printed Smart Brick ● Introduction to assignment

	Nov 2019 – Mar 2020	Students develop their assignment
8	Dec 2019	Assignment: tutorial & discussion
8	Feb 2020	Assignment: tutorial & discussion

2st Module (2020)		
Seq	**Date**	**Content**
9 10 11 12 13	TBD Mar 2020 9-12h	Use volumetric modelling design a building envelope optimizing performative aspects. Deliverables: ● 3D model of a performative building envelope. ● Performative Analysis of this building envelope. ● Predefined renderings of the model ● 3D printed scale model of a representational part ● A description of the methodology, results, and discussion Final Project presentation

Assessment

Project assignment
Project Presentation
Class participation

References

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Inscrições

Vagas limitadas

Inscrições abertas até 06 de Novembro de 2019.

Formulario on line.

Sponsorship

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