

PENS-201

Making structural logic

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Cursus	Sem.	Type
Projeter ensemble ENAC	BA4	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	
Hours	48 weekly
Courses	4 weekly
Exercises	22 weekly
Project	22 weekly
Number of positions	
It is not allowed to withdraw from this subject after the registration deadline.	

Summary

This ENAC week provides students with the opportunity to apply theoretical structural principles in an applied context through the collaborative design of textile reinforced concrete shells that test structural and material limits. The ENAC week will take place in the Blue Factory at EPFL Fribourg.

Content

The workshop will:

1. explore a structural theory through applied investigation;
2. use reiterative testing and design to develop an idea;
3. explore the limits of materiality and dimensioning such that design failure can be learned from;
4. challenge students to collaborate in diverse intellectual, creative and hands-on situations across disciplinary backgrounds.

The research of the ENAC week will link to the *Unité d'Enseignement Argamassa Armada*, that looks at the ferrocement work of the Brazilian architect João Filgueiras Lima (known as Lelé) by means of a reiteration in textile reinforced concrete. Since 2019 this research has become more visible in the TRC prototype pavilion that is under construction at EPFL Fribourg, an ENAC Summer Workshop. Through this overlapping with the UE and the construction of the TRC prototype pavilion, the ENAC week will provide students with a context to the applied research that they are themselves undertaking.

The objective of the week will be for students to design and test shell elements in textile reinforced concrete. We will test shells with formwork in folded metal and shells with a hanging membrane as formwork.

The 1:1 fabrication will occupy the largest part of the students time and energy: in bringing together students from the different ENAC schools, this opportunity to design, calculate and build in 1:1 structural elements, offers a unique chance to directly experience ways of thinking, working together, and making. The human exchanges engendered by the work could test the disciplinary boundaries that sometimes prevent students from exploring. The 1:1 fabrication also confronts students with the power of scientific discovery through the observation of nature; forces, materials-behavior and failure become a direct vehicle for learning.

Keywords

technological and social innovation, sustainable construction, knowledge transfer, pedagogy of making

Learning Outcomes

By the end of the course, the student must be able to:

- Design a structural element / system in textile reinforced concrete
- Construct an innovative formwork system
- Dimension a structural element in textile reinforced concrete
- Test structural and material limits

Transversal skills

- Negotiate effectively within the group.
- Resolve conflicts in ways that are productive for the task and the people concerned.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Demonstrate a capacity for creativity.
- Take feedback (critique) and respond in an appropriate manner.

Teaching methods

Working at 1:1 scale will require students to use drawing, model, calculation and collaborative investigations to design prototypes, details and a successful scheme. Testing sessions throughout the week and the students' documentation of this testing, will push designs to failure and lead to a reconsideration and redesign of the proposal.

Expected student activities

1. *Lélé (Argamassa Armada)*: (1 hour lecture). This exchange will introduce Semaine ENAC students to the research being conducted in the Argamassa Armada *Unité d'Enseignement*. It will include a short introduction to the work of Lélé and the system of reinforced concrete that he developed in Brazil.

2. *Fabrication* (6, 4-hour collaborative blocks). Students will work in interdisciplinary teams to develop a concrete form-work that pushes material limits. The module will be introduced at the beginning of the week with students working each day to design and fabricate a proposal.

We will provide an interdisciplinary framework for the workshop that opens paths for future questioning. They are essential to the success of the week and provide a context and spirit for the investigation.

The 1:1 fabrication will occupy the largest part of the students' time and energy: in bringing together students from the different ENAC sections, this opportunity to design, calculate and build a 1:1 structure offers a unique chance to directly experience ways of thinking, working together, and making. The human exchanges engendered by the project could test the disciplinary boundaries that sometimes prevent students from exploring -- on both a personal and intellectual level -- the other sections within the school. The 1:1 fabrication also confronts students with the power of scientific discovery through the observation of nature; forces, materials, behavior and failure become a direct vehicle for learning.

Assessment methods

Ongoing evaluation; students will be evaluated on the basis of the following criteria:

- ability to work in drawing and 1:1 construction;
- capacity to use testing as a means of advancing an architectural and structural idea;
- collaboration (communication, team work, flexibility within different roles);
- engagement (participation, initiative, responsibility)

Supervision

Others The faculty team will be with the students on a continual basis throughout the workshop period.

Resources

Bibliography

Selected Readings

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