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 a concrete formwork that tests structural and material limits.

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. and challenge students to collaborate in diverse intellectual, creative and hands-on situations across disciplinary backgrounds.
The research of the *Semaine* ENAC will link to the *Unité d'Enseignement* Argamassa Armada, that looks at the reinforced concrete research of the Brazilian architect João Filgueiras Lima (known as Lélé). Through this overlapping with the UE, the *Semaine* ENAC 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 an innovative formwork system for a textile reinforced concrete element. The goal will be to bring into functional correlation the flexible behavior of textile reinforcement and the necessary rigidity of the formwork for obtaining a minimal dimensioning of the element.
The second year ENAC program marks a moment when theoretical learning is confronted by constraints inherent in applied research. The*Semaine ENAC* has an important potential to address this shift and the larger objective of the current proposal is to provide students with the tools to take part in such a dynamic.

Learning Outcomes

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

- Analyze the elements and construction systems of Lelé
- Draw to resolve tectonic and structural questions
- Construct innovative 1:1 formwork systems
- Develop a project and experiment together
- Test structural and material limits
- Explain to other group members and responding to group critique

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. Drawing across disciplines (1-hour lecture). This lecture will look at the ways drawing has been used as a tool for research and design by architects and engineers throughout history and at different scales of investigation. The distinctions between sketch, hard-line and diagrammatic drawings will be developed through historical and contemporary examples. The role that drawing plays as a tool for interdisciplinary communication will also be examined and students will be encouraged to develop their projects using different forms of drawing as a primary means of research.
2. Material investigations : wood, concrete, steel (1 hour lecture/visit). This module looks at the behavioral properties of different materials and is structured around visits to material-testing laboratories on the EPFL campus.
3. 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.
4. Fabrication (6, 4-hour collaborative blocks). In this final module, 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. The theoretical inputs received from points 1, 2, 3 and 4 will inform the decisions and design.
Modules 1-3 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 schools, 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 four following criteria:

1. ability to work in drawing/model and 1:1 construction;
2. capacity to use testing as a means of advancing an architectural or structural idea;
3. collaboration (communication, team work, flexibility within different roles);
4. engagement (participation in exercises, analytical work, initiative)

Resources

Bibliography

Selected Readings
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