Interactive conceptual design of structural forms

Summary

The class exposes students to the geometric design of material efficient architectural structures. The focus is placed on the conceptual exploration of a rich, diverse solution set. Hand-controlled methods and parametric tools are used, as well as strategies to rapidly take key decisions.

Content

• Introduction to the value of structural geometry towards the architectural project;
• Introduction to the role of design-oriented assumptions in engineering;
• Strategies for selecting and transforming load-bearing systems;
• Principles of structural design-oriented physical models;
• Formal explorations using graphic statics and force paths;
• Introduction to parametric modelling and form-finding tools;
• Historical illustrations of interactive structural design exploration.

Keywords

• Architectural structures
• Interactive conceptual design
• Force shaping
• Ressource-efficiency
• Parametric design

Learning Prerequisites

Required courses
EPFL bachelor classes on statics, structural design or equivalent.

Learning Outcomes

By the end of the course, the student must be able to:
• Choose a structural system that is relevant to given architectural, technical and environmental contexts
• Sketch a wide variety of structural forms that originally address specific issues
• Infer the geometric degrees of freedom in a given structural typology
• Use a computational tool for graphical parameterization
• Identify structural solutions that require less material for construction
• Modify a structural solution to enhance its mechanical behavior

Transversal skills
• Use a work methodology appropriate to the task.
• Communicate effectively with professionals from other disciplines.
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Set objectives and design an action plan to reach those objectives.

Teaching methods
• Lectures on board or slides
• Discussions based on readings
• Theoretical and hands-on exercises, in class and homework assignments

Expected student activities
Regular work throughout the full semester and interaction in the class room.

Assessment methods
The class is punctuated by four assignments:
1. physical and numerical design of shells (15%);
2. parametric design of simply-connected networks (15%);
3. parametric design of reticulated systems (15%); and
4. conceptual design project (35%)
The final oral exam is worth the remaining 20%.

Supervision
Office hours Yes
Assistants Yes
Forum No

Resources
Bibliography
Form and Forces / Allen & Zalewski

Ressources en bibliothèque
• Form and forces / Allen & Zalewski

Notes/Handbook
Slides and readings will be published on Moodle.

Websites
• http://sxl.epfl.ch/teaching

Prerequisite for
Projet de master