

PENS-308

**Argamassa armada**

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Cursus	Sem.	Type
Projeter ensemble ENAC	BA6	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	12
<b>Hours</b>	<b>4 weekly</b>
Courses	1 weekly
Project	3 weekly

**Number of positions**

**It is not allowed to withdraw from this subject after the registration deadline.**

**Summary**

The UE Argamassa Armada will develop prototypes of structural elements in textile reinforced concrete (TRC) that allow the continuation of the TRC prototype pavilion started at EPFL Fribourg in 2019. The UE will take place in the Blue Factory in Fribourg.

**Content**

At the basis of the research questions lies the crossing of contemporary structural research into textile reinforced concrete (TRC) with architectural work in *argamassa armada* (ferrocement) done in Brazil by the architect Filgueiras Lima (Lelé) from ca. 1970-2000. Textile reinforced concrete allows to reiterate a building technique - *argamassa armada* - that was highly developed in Brazil but in the last years was nearly abandoned due to problems of corrosion. TRC (using non-corrosive reinforcement) is on the other hand starting to be used in Europe, yet for a very limited field of applications. It holds the promise to drastically reduce the CO2 footprint of concrete; its structural potential however is still not fully explored and its application potential unknown to most engineers, architects and scientists in practice.

The UE *Argamassa Armada* aims at exploring the structural, architectonic and environmental dimensions of TRC and share them with our project partners at the University of Bahia (FAUFBA) in Salvador de Bahia, Brasil.

After a first period of analysis, empirical research through 1:1 tests will be led at EPFL Fribourg. Students will produce formworks in folded metal and cast prototypes of structural elements in textile reinforced concrete.

**Keywords**

Textile reinforced concrete (TRC), construction, technological innovation, knowledge transfer, interdisciplinarity

**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 in folded metal
- Dimension a structural element in textile reinforced concrete
- Test structural and material limits

**Transversal skills**

- 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.
- Communicate effectively with professionals from other disciplines.
- Communicate effectively, being understood, including across different languages and cultures.

### Teaching methods

Work will take place in an atelier format, through drawing, 1:1 testing and collaborative discussions. It will be supported by lectures.

### Expected student activities

Students will need to understand and go through the complete process of analysis, conception, execution and testing:

1. Conceptual design of a structural element
2. Conception and construction of formwork in folded metal
3. Placement of textile reinforcement in the formwork
4. Casting of concrete, unmolding
5. Scientific protocol of the technical information and functional layout of the element and casting process
6. Measuring of resistance and ductility in the IBETON laboratory

### 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

Office hours	Yes
Assistants	No
Forum	No
Others	The UE will take place in the Blue Factory in Fribourg. The train tickets will be reimbursed.

### Resources

#### Bibliography

##### *Selected Readings*

Cruz Prieto, Fabio: *De l'observation*. Vina del mar: Inéditos, 1993.

De Oliveira, Olivia: *L'architecture brésilienne sous les projecteurs*. L'ARCHITECTURE D'AUJOURD'HUI 396 72-77.

Ekerman, Sergio Kopinski. *L'œuvre multiforme de Lelé*. L'ARCHITECTURE D'AUJOURD'HUI 396 64-71.

Farias, Bruno Fialho; Netsch, Stefan. *Die Methode Lelé*. BAUWELT 5.14 26-31.

Kaltenbach, Frank. *From tradition to Tourist Attraction - Prefabrication in the Timber Construction of the Dong People*. DETAIL 6/2012 594-598

Kulas, C: *Actual applications and potential textile-reinforced concrete*. Solidian GmbH, Germany, GRC 2015.

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Serapião, Fernando: *Fragments of a Lover's Discourse - Brazilian Architecture and Reinforced Concrete*.

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Olmos, Susana Acosta; Cordiviola, Chango; Ekerman, Sergio Kopinski: *L'humain au cœur de la fabrique architecturale*. L'ARCHITECTURE D'AUJOURD'HUI 396 52-63.

Rice, Peter: *An Engineer Imagines*, Artemis 1994

Schittich, Christian: *Prefabrication- High- Tech and Manual Production*. DETAIL 6/2012 588-598

Wilson, Colin St. John: *The sacred buildings and the sacred sites*. OASE 45-46 / 1997 64-87

### Websites

- <https://www.epfl.ch/schools/enac/education/design-together-en/enac-summer-workshops/a-prototype-pavillon-in-textile-reinforced-concrete/>
- <https://actu.epfl.ch/news/epfl-students-push-the-boundaries-of-concrete-engi/>