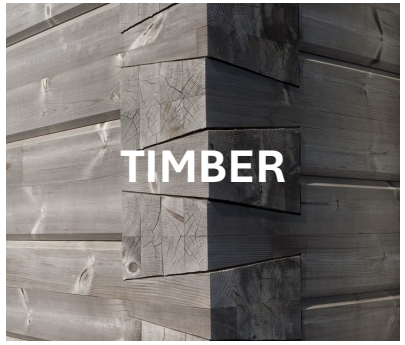
EPFL
iBOIS

UE A ARCH MA2 + GC MA: Patterns for Bio-Based Material Envelopes
-
Spring 2027

# 01 | Introduction


Prof. Yves Weinand
Assistants Juris Strangots,
TsungWei Cheng Mike

# Inspiration from bio-based materials and vernacular architecture

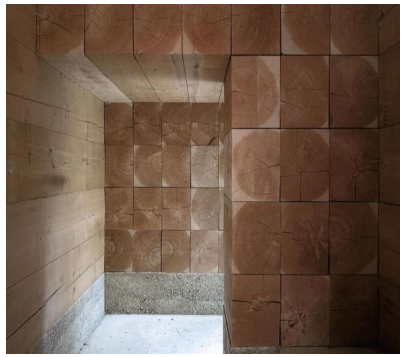


**Mosque of Djénee**
Mali

**Stabbur**
Norway

**Turkana hut**
Kenya

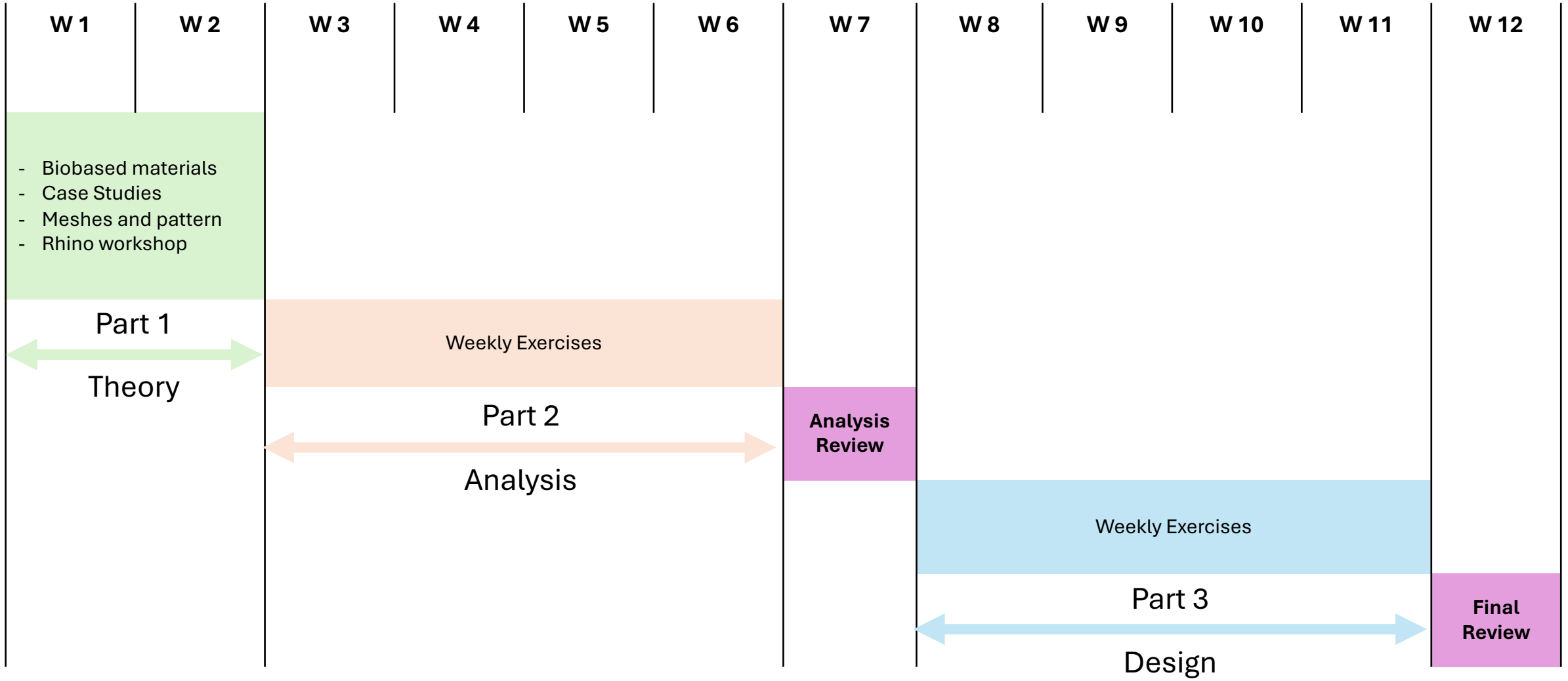
**Rammed earth house**
Martin Rauch
Austria



**Wooden chapel**
John Pawson
Germany

**Tatched Museum**
Guinée*Potin,
France

# Course schedule – **3 Parts**



- Introduction to categories of bio-based materials and their characteristics
- Introduction to the notions of mesh and pattern in architecture
- Case studies on the implementation of bio-based materials
- Presentation of the case studies selected for the exercise
- Introductory Rhino workshop on the modeling of wireframe structures, patterns, and meshes

# **Part 2 Analyse** - Vernacular Case studies – 5 weeks

**Musgum mud house**
Cameroun

**Omo Sebua House**
Nia, Indonesia

**Muddif House**
Irak

**Esfahk Mud Center**
Iran

**Madrier House**
Cornelihus, Switzerland

**Kings Palace**
Rwanda

Weekly analyse with specific thematics :

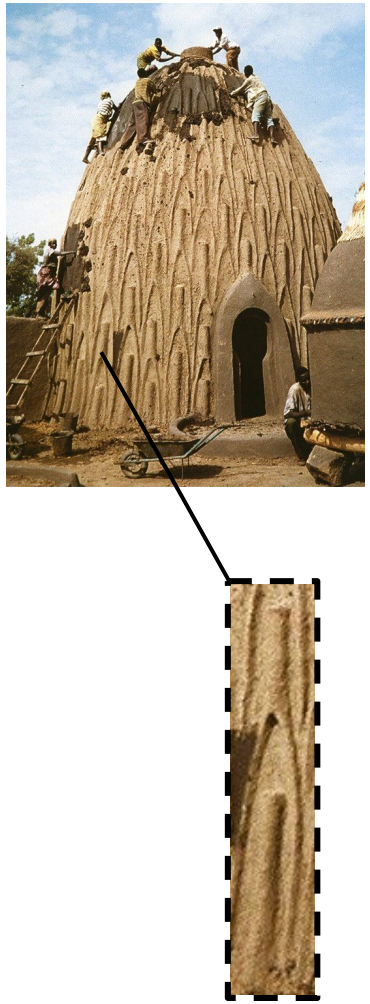
- Principles and identification of patterns (Overall geometry, etc.)
- Geometry and meshes (3D model, identification of components, mesh model)
- Details (identification of main nodes, scaled construction drawings, structural characterization)
- Structural analysis and assembly sequence (structural behavior, necessary assembly steps)
- Synthesis (report and presentation)

**Deliverable**

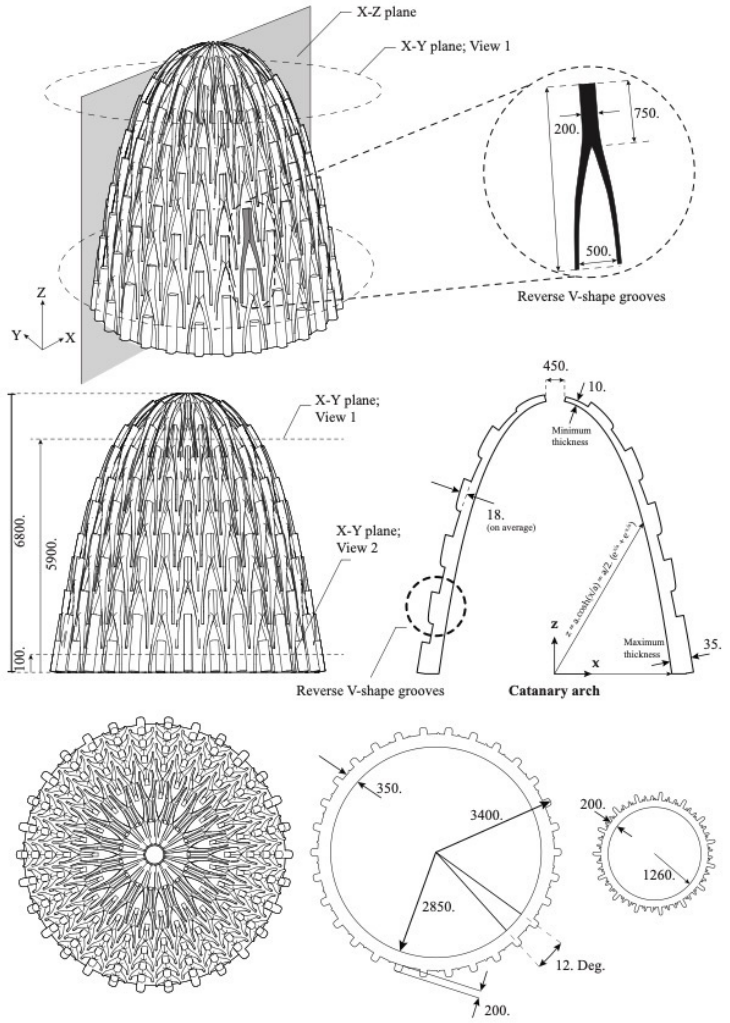
Each group will present their analysis during a 20min oral presentation.

# **Part 2** – Exemple Musgum Dome

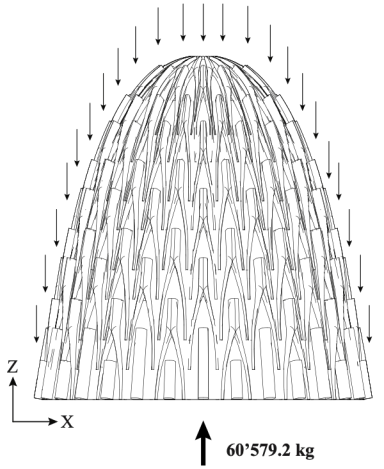
## Identification



## Characterisation

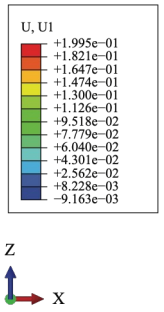


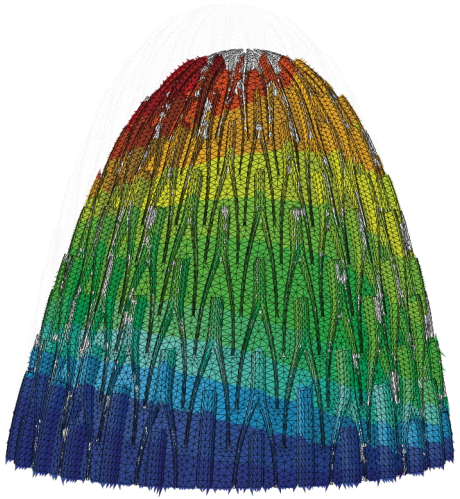

## Analyse




| Property | |
|---|---|
| Density (kg/m3) | 1950. |
| Poisson's ratio | 0.25 |
| Young's modulus (MPa) | 700. |
| Dry compressive strength (MPa) | 5.0 |
| 28 day tensile strength (MPa) | 1.0 |
| 28 day bending strength (MPa) | 1.0 |
| 28 day shear strength (MPa) | 1.0 |

Houben, H. and Guillaud, H. (1994) Earth Construc
Intermediate Technology Publications, London.



# **Part 3 Design** – New Envelope – 5 weeks

Students develop a structural envelope with new architectural expression, directly derived from a radical and contemporary application of bio-based materials.

- Respect the overall geometric principles (form and proportions) of the case study
- Use exclusively bio-based materials for the new envelope
- Integrate the structural capacity of the envelope (self-supporting or load-bearing)
- Ensure water and airtightness
- Incorporate thermal insulation
- Form a coherent and braced structural system
- Develop an architectural expression derived from the materials and their specific methods of implementation

**Deliverable**

Each group will present their analysis during a 20min oral presentation.

# Evaluation

**Case Study Analysis (Part 2) : 40%**

- Ability to clearly present the key issues and challenges
- Ability to produce a 3D model of the overall geometry and identify the different elements
- Ability to represent detailed plans, sections, and elevations at a scale of 1:50
- Ability to understand and represent construction details at a scale of 1:20 (materiality, dimensions, etc.)
- Understanding of the static scheme and the structural behavior of the key nodes

**Envelope Design (Part 3) : 60%**

- Understanding of the architectural and constructive challenges of the proposed design
- Overall coherence of the project and resolution of specific issues (weathertightness, structure, etc.)
- Relevant integration of bio-based materials
- Ability to represent plans, sections, elevations, and axonometric drawings
- Ability to understand and represent construction details at a scale of 1:20 (materiality, dimensions, etc.)
- Understanding of the static scheme and the structural behavior of the key nodes