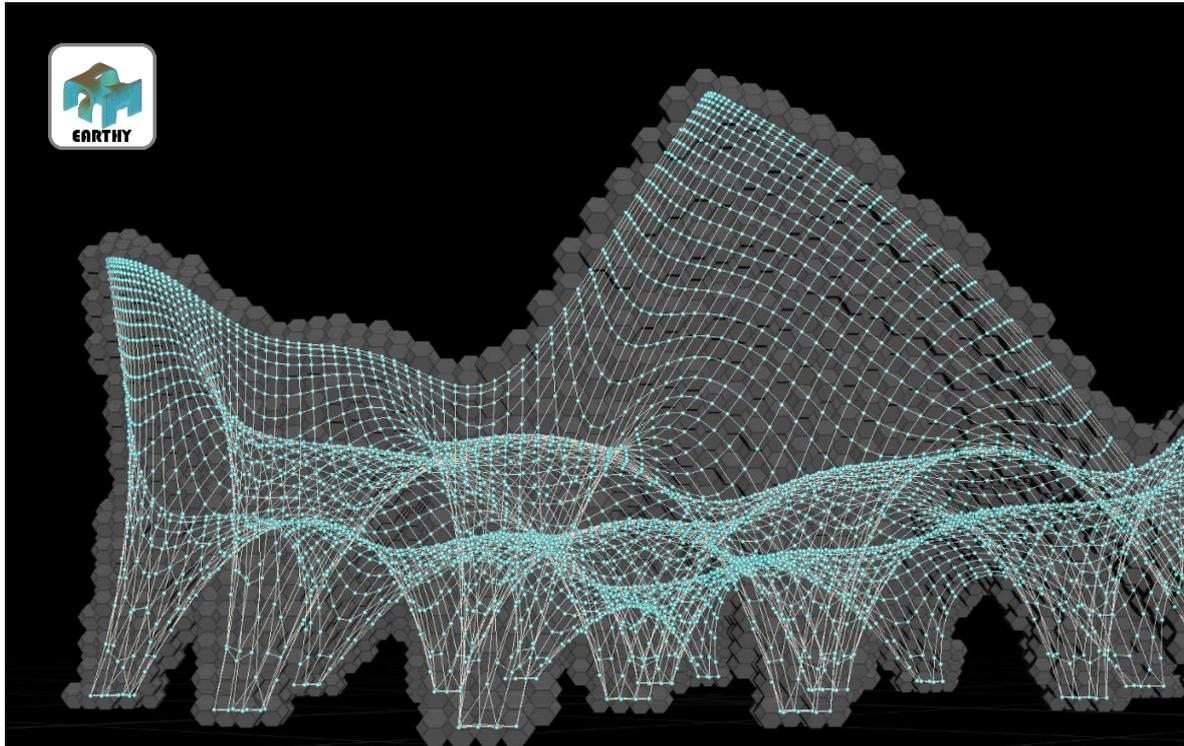


EARTHY Studio 4.0

Computational Design for Earth and Masonry Architecture



Tutors

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Code	AR3B011
Credits	15 ECTS
Location	BK, Delft
Excursion	No
Costs	≤ 25 € <i>per person</i>

EARTHY is a master's level design studio with the aim of designing and engineering earthy buildings, in particular adobe buildings, intended for mid-term accommodation of displaced communities. Our goal is to design buildings that can be ideally co-designed and built by their prospective inhabitants. Earthy buildings are virtually 100% recyclable and, compared to tents, they offer much more comfort. The use of earthen or masonry materials necessitates the knowledge of complex geometry, shape optimization and topology optimization e.g. in designing and technical drawing of vaults, domes and arches in optimal shapes. The focus of the course is on the relations of materials, forms, and structures, explored computationally. Automated construction design and generation of assembly instructions are extra challenges to be tackled via computation.

Motivation

Earth architecture is a sustainable choice especially in arid climates, because of using mostly in situ available materials, thus removing the need for carbon intensive transportation, low/zero embodied energy content of building materials, good climatic performance of earth buildings using passive design strategies, etc.

In addition, building only with earth/masonry materials

provides an ideal didactic context for learning computational design as it presents structural design and constructability challenges that can be dealt with through computational design, where the optimality of the shape is critically important for the stability of the structure. Earthy buildings need to be mostly compression-only structures and that entails that they end up having complex geometric shapes. Considering scarcity of vernacular building technology crafts required for building earthy structures, novel methods need to be engineered to make such complex-shaped buildings easily constructible.

Methods

The process of design will consist of three main phases, corresponding to which there will be assignments:

- Configuring: arrangement of a settlement for a displaced community considering the accessibility of amenities, and functional layout of communal/public buildings;

- Forming: devising the 3D shape of the buildings based on their functional configuration, climatic functionality, and structural performance;

- Structuring: construction design of an earth building for a zero-waste circular construction process.

All these phases need to be carried out computationally, that is by means of computer programming (Python or C#) and computational workflows in McNeel's Grasshopper or in Jupyter Notebooks.

Design Challenge:

Designing a few public buildings and housing units for mid-term accommodation of a displaced community will be the challenge.

[Introductory Paper](#), Video [Earthy 2.0](#), Video [Earthy 3.0](#)