Unione Europea

UNIVERSITÀ DI PARMA

SDIA PhD in Civil Engineering and Architecture

THERMO-MECHANICAL OPTIMIZATION: APPLICATION TO PRECAST BUILDING CLADDINGS

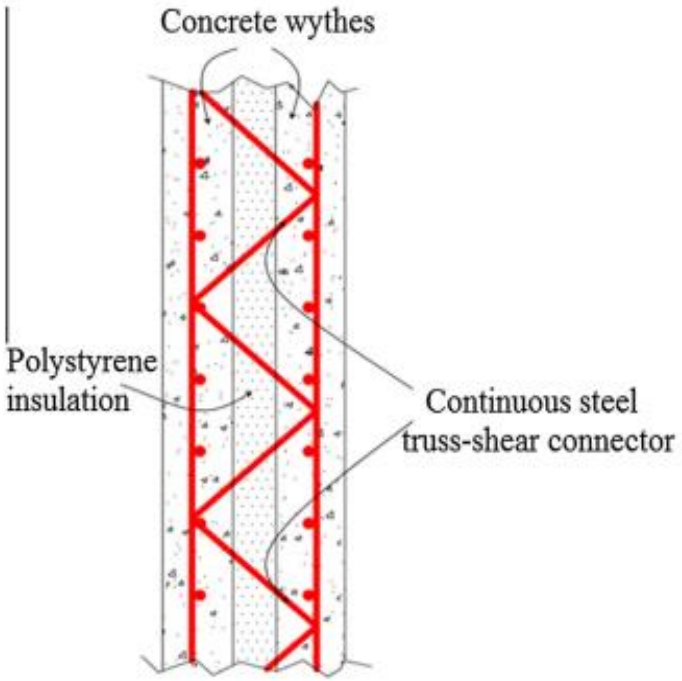
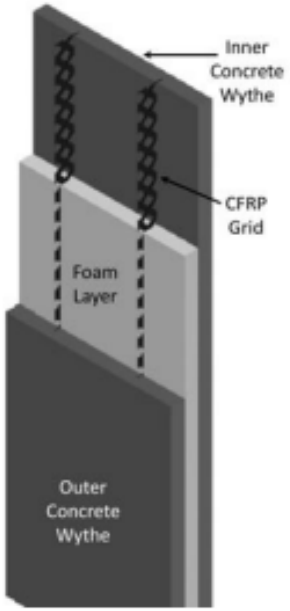


Fig. 1. A continuous steel truss-shaped shear connector.

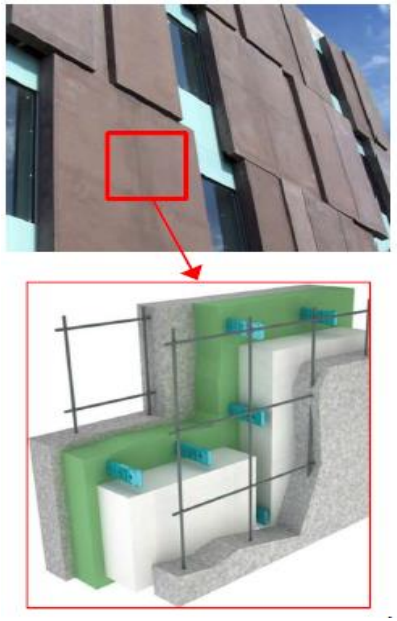


Different Connector Materials:

- **Concrete:** conductive
- **Metal:** heavy and conductive
- **CFRP:** thermal resistor but brittle
- **Polymers:** Thermal resistor but not stiff

Solution:

- **Combined metallic and polymeric connector**

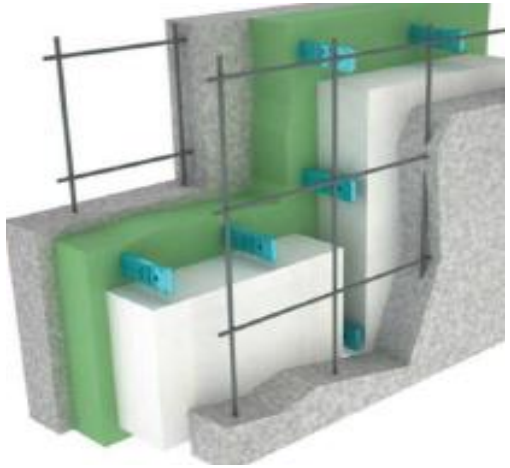


Farzad Tatar, Aug 10th , 2022, Supervisor: Prof. Roberto Brighenti

Topics to be touched

Thermal Requirement:

- **Comply with energy consumption standards**

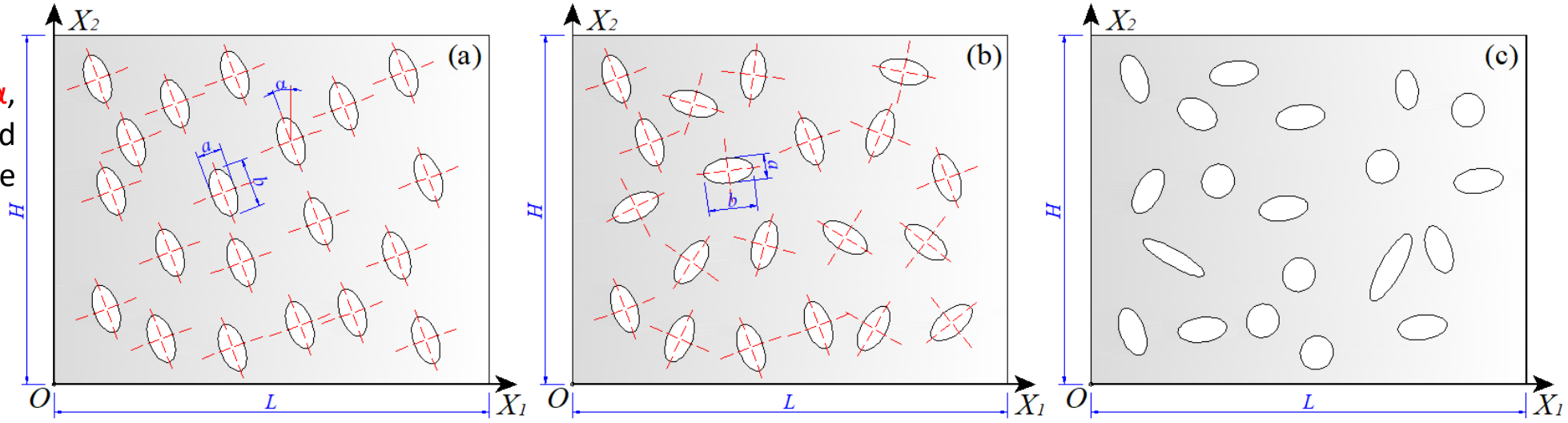


Mechanical Requirements:

- **weight of the supported wythe**
- **consequent creep**
- **buckling**
- **lateral forces**
- **expansion loads**
- **seismic loads**

Project on the thermo-mechanical optimization:

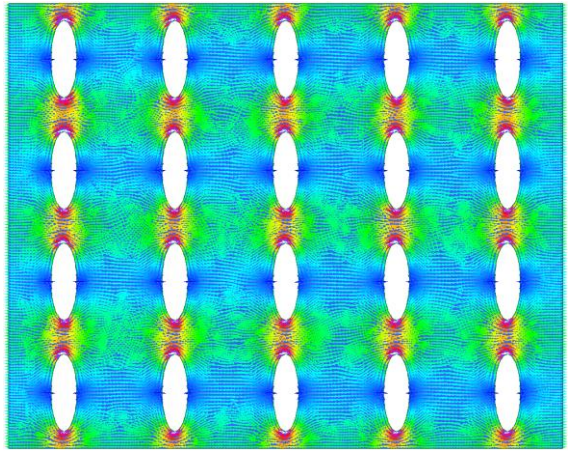
The effect of a, b, α, and number and position of holes have been studied.

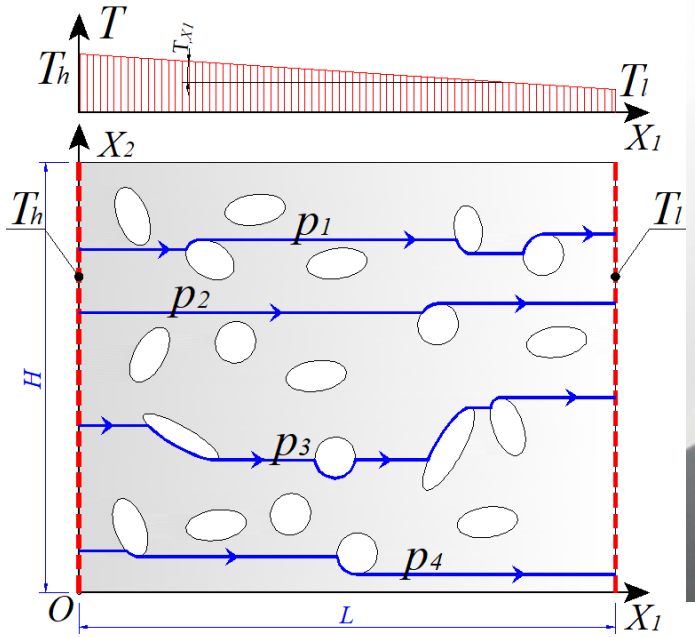


What that has been done

Expected results:

1. Optimal thermo mechanical performance of an advanced structure
2. Experiments (**Tensile Tests** on the printed specimens)
3. A **predictive model** for the thermal performance
4. One **paper under preparation** entitled: Optimal thermo-mechanical coupled response of 2D metamaterials
   - In this work, random elliptic holes with different parameters were created to optimize the thermal resistance and stiffness of metamaterial plates

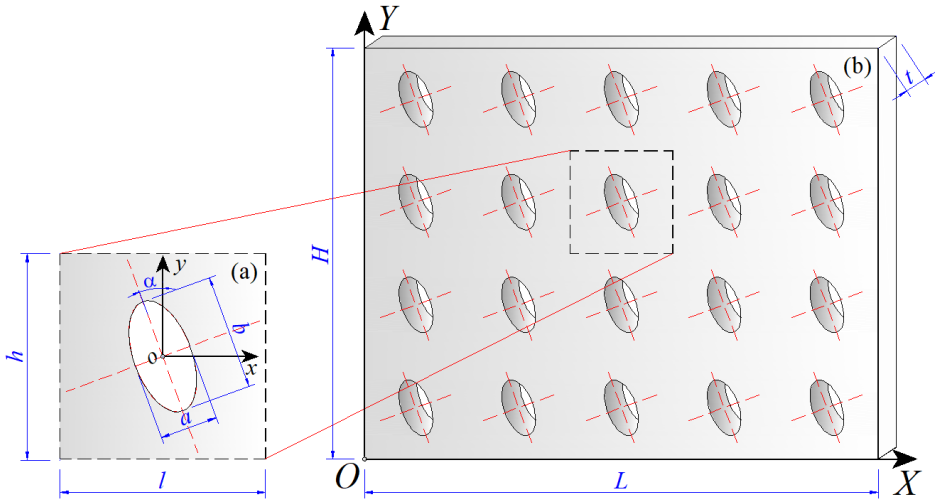




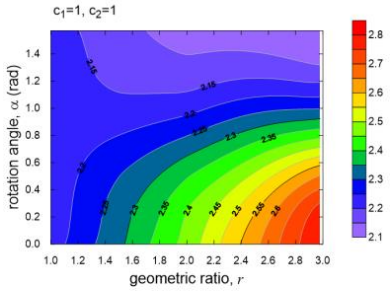
What that has been done

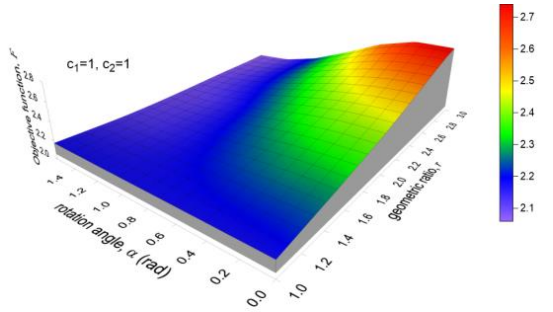
Optimization function

$$f(\beta_i) = c_1\, f_M(\beta_i) + c_2\, f_T(\beta_i)$$

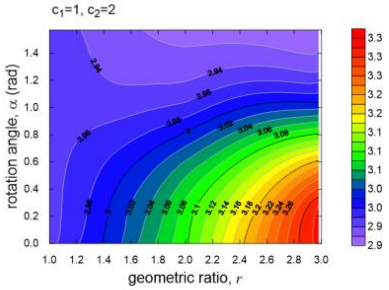


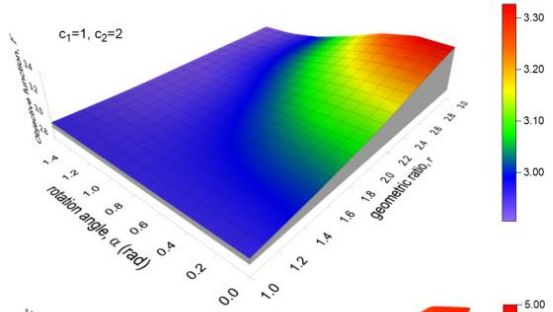
c1=c2=1





c1=1 c2=2





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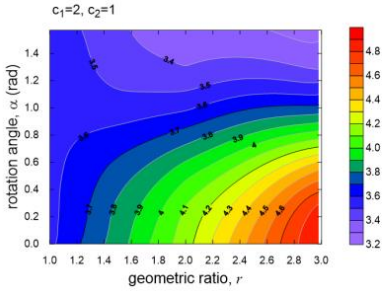

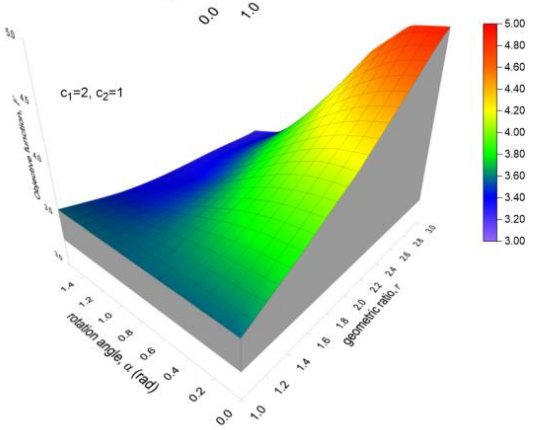

Finally, I spent two months as an exchange PhD student at the Polytechnic University of Timisoara, Romania from July to August

Thank you for your attention