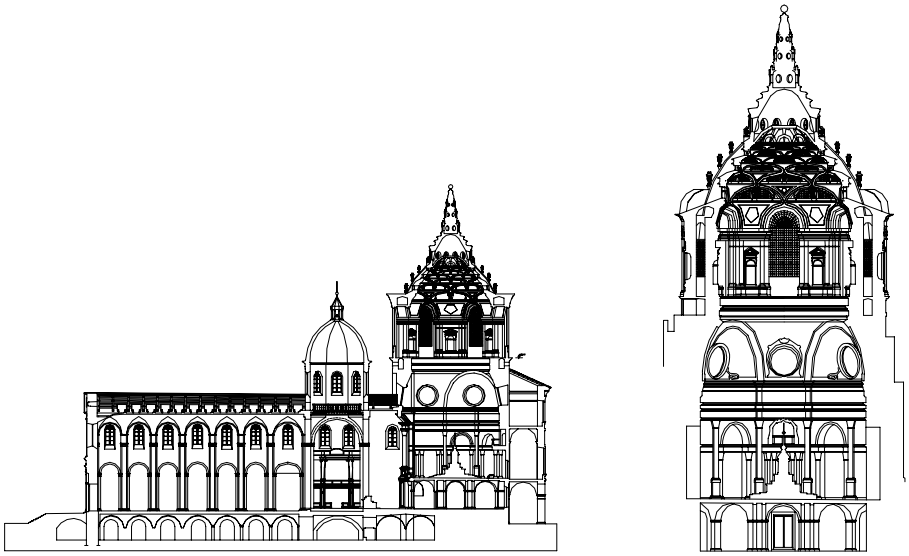
Holy-Shroud Chapel, Torino, Italy

Project Description:

- Designed by Guarino Guarini, built from 1667 to 1694
- Heavily damaged by fire in 1997
- Governmental contract with Politecnico di Torino to provide a project for a general experimental campaign on materials and structure (P. Napoli) and a dynamic test programme (A. De Stefano)
- Governmental contract with Politecnico di Torino (A. De Stefano) and University of Kassel (Link) to provide a numerical model refinement and model updating



Holy shroud chapel

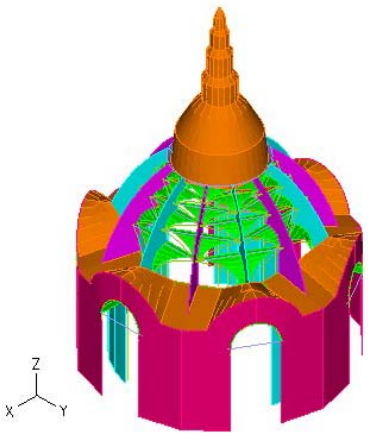
Quick Facts:

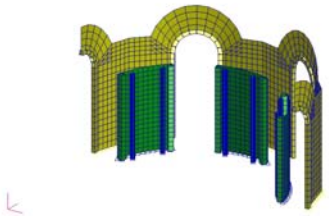
- **Name and Location:** Holy-Shroud Chapel, Turin, Italy
- **Owner:** Italian Government
- **Structure category:** Monumental building: high-valued architectural treasure built in XVIIth century
- **Height:** about 80 m.
- **Structural system:** clay-brick masonry, decorated stone internal layer, iron confining belts. unknown interaction between brick masonry and stone layer
- **SHM:** planned but not yet executed (except for preliminary ambient vibration tests)
- **Number of tests and sensors:**
    - 10 destructive lab tests
    - 73 flat jack tests on site
    - 41 inclinometers
    - 34 temperature sensors
    - 16 strain sensors
    - 14 three-axial accelerometers

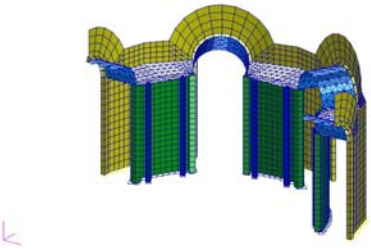
- **Instrumentation design by:** Department of structural and Geotechnical Engineering, Politecnico di Torino, Turin, Italy

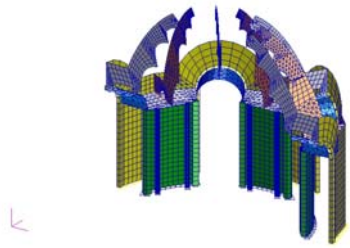
Description of Structure:

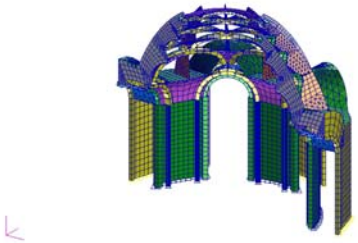
The architecture of the chapel is highly scenic, the structure, in clay bricks, is fully hidden. It seems that the structural shape is less rigorously organized and less regular than the architectural organization allows imagining. A redundancy in internal restrains compensates, somehow, the lack of regularity. The structural complexity is high and can be illustrated by the structural FE model.

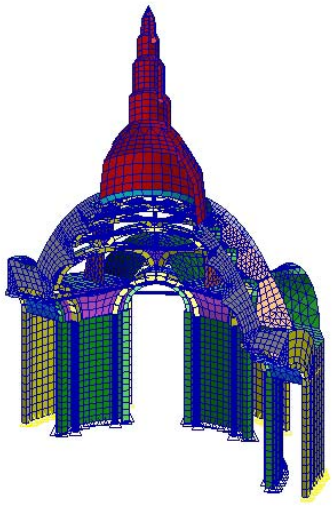

Z
X
Y

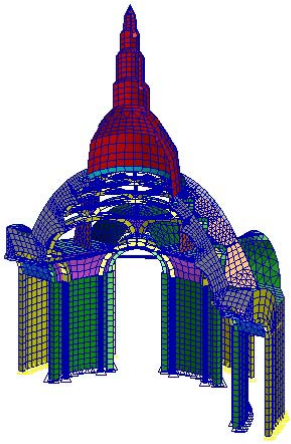


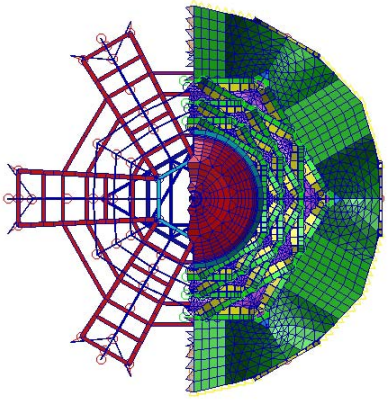


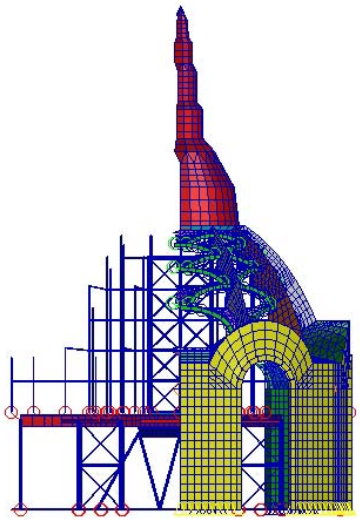


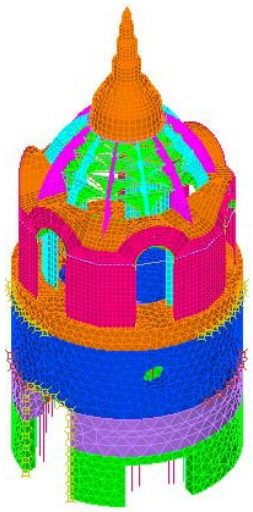












Purpose of Inspection:

After the fire induced damages it was necessary to design a retrofitting intervention. To help to select the most reliable choice it was recognized the needing of a well assessed model, able to reduce the uncertainty level. The experimental campaign was object of a contest among a number of invited companies. The whole test campaign will included ambient vibration tests and vibration tests under impulsive excitations, caused by a mass falling on a pile head in the near field.

The model includes the scaffold to keep into account the interaction between it and the structure.

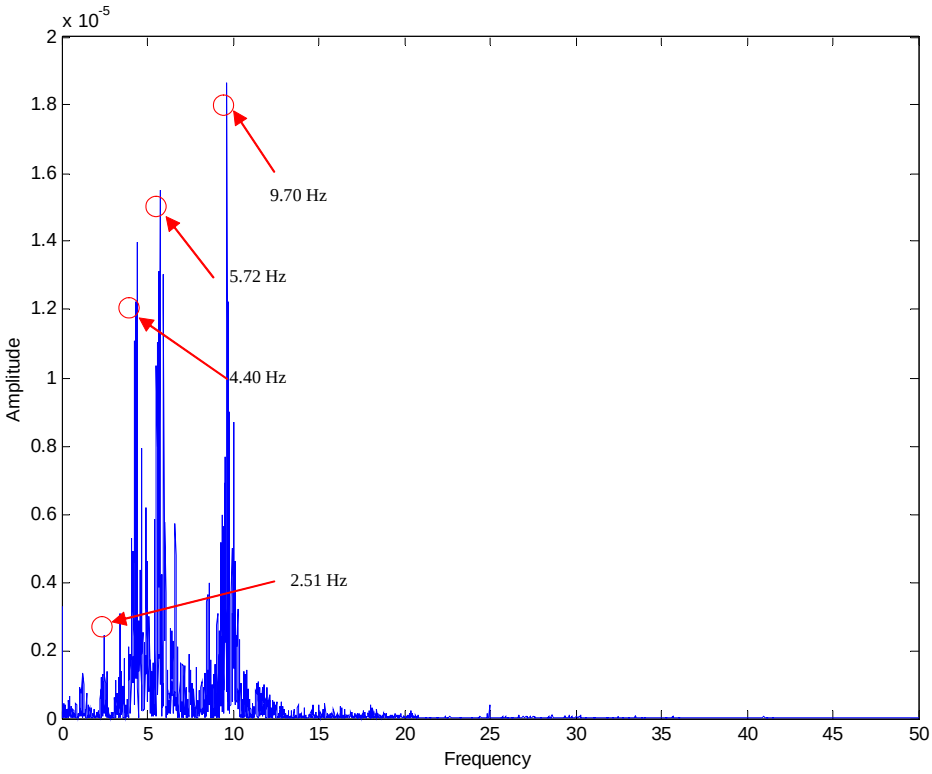
Tests and Sensor: details*:

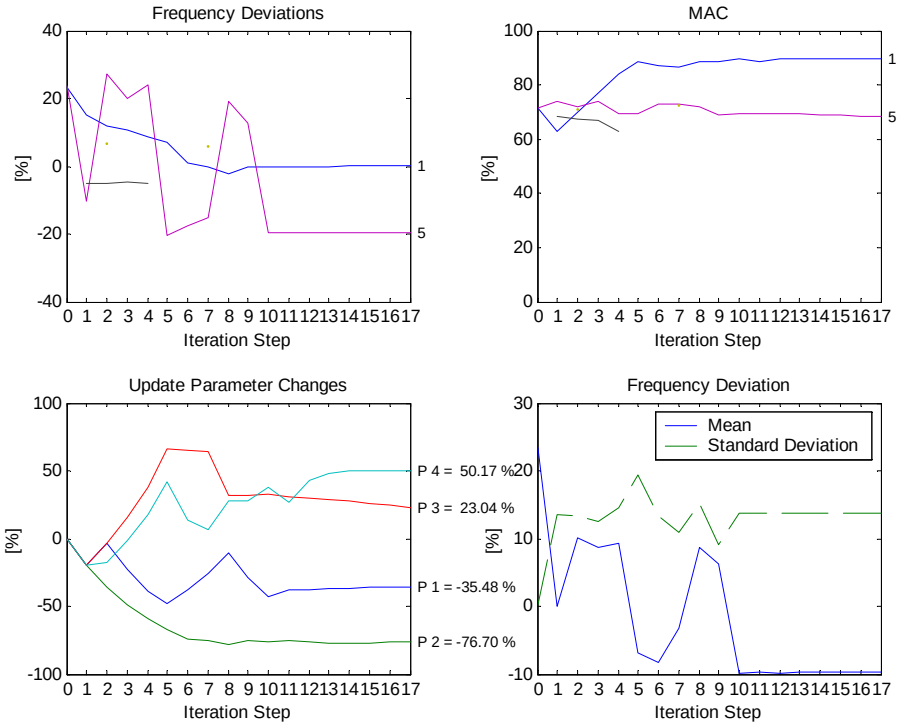
Type	Number
Cylindrical foundation and soil samples: extraction and test	# 10
Flat jack tests:	# 73
inclinometers	# 41
Temperature and heat flow sensors:	# 34
Strain sensors:	n. 16
3 axial accelerometers:	n. 14

Examples of Outcomes:

An upgradeable model was built-up by Politecnico and Kassel University and preliminary updated on the base of a reduced initial set of ambient vibration tests. Those tests were conduced under the excitation produced by the turbulence generated by the rotor of a fire police helicopter.

The recorded data were enough to identify reliably the first and fifth modes.





An upgradeable model was built-up by Politecnico and Kassel University and preliminary updated on the base of a reduced initial set of ambient vibration tests. Those tests were conduced under the excitation produced by the turbulence generated by the rotor of a fire police helicopter.
The recorded data were enough to identify reliably the first and fifth modes.

Benefits of using SHM Technologies in the Project:

The whole test campaign will included ambient vibration tests and vibration tests under impulsive excitations, caused by a mass falling on a pile head in the near field.

Submitted by:

Alessandro De Stefano
Politecnico di Torino, Turin, Italy