

Honors theses

Dynamical and seismic analysis of the Church of “Madonnina della Neve” in Savigliano (CN)

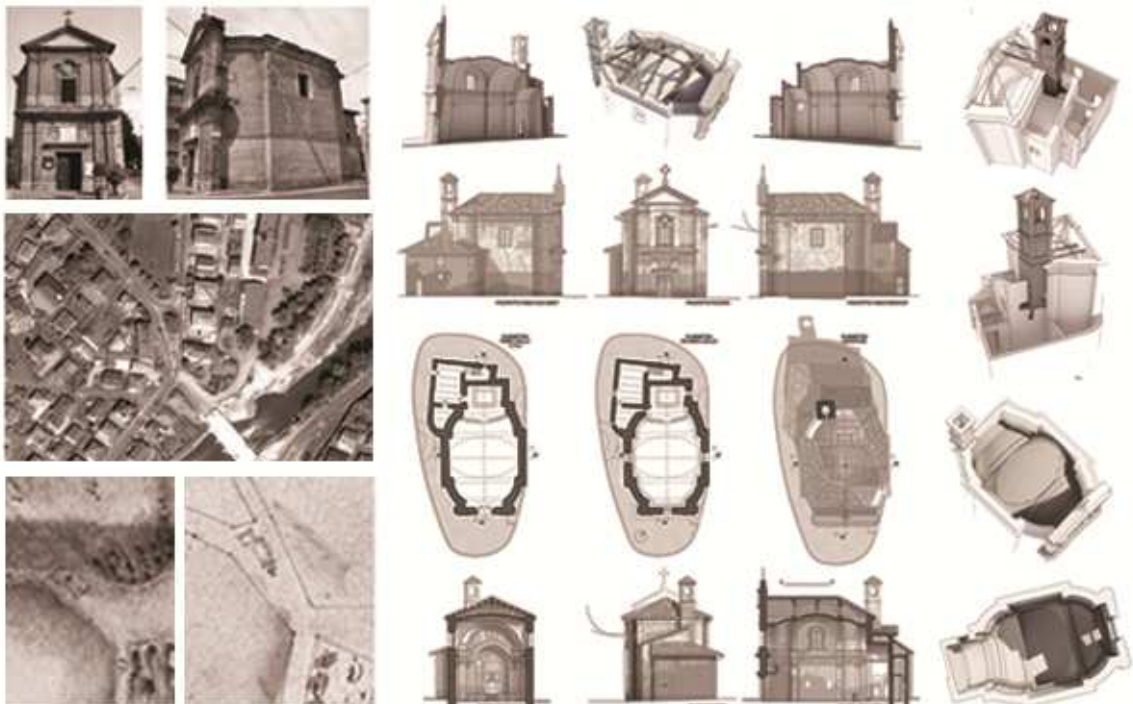
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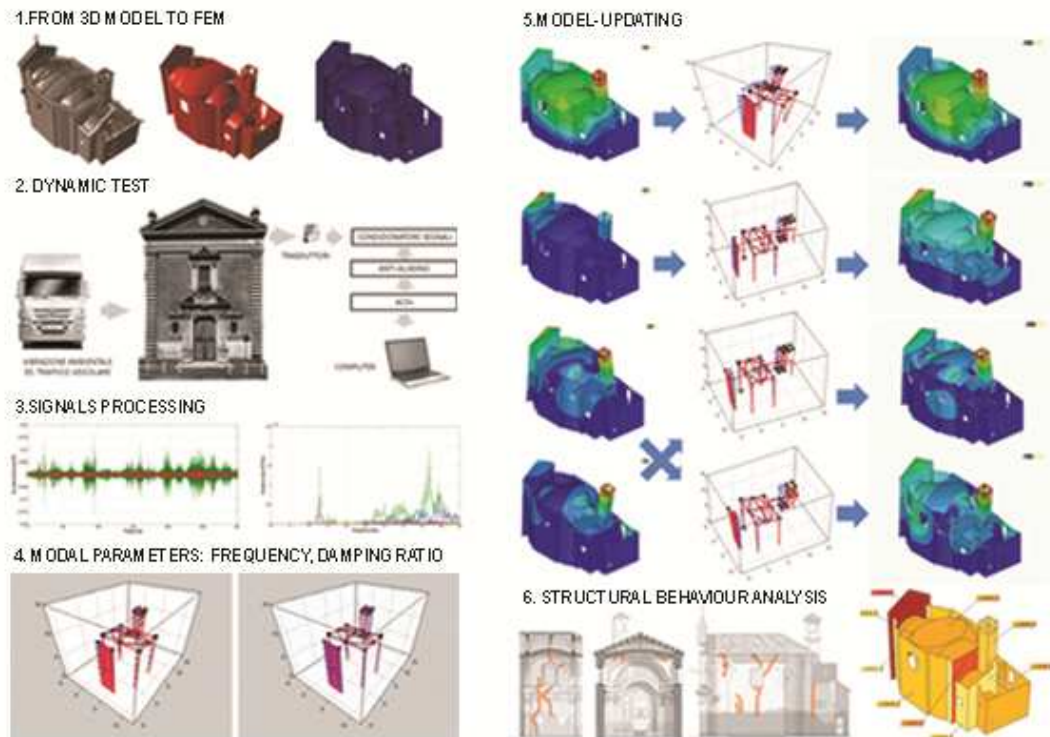
The richness of the Italian cultural heritage, as well as the problem of its conservation and enhancement, has always been a very topical issue. Specifically the question of the heritage buildings reinforcement regards the intent to pass it on to the posterity in its structural integrity, but at the same time it has to be compared with the security problem. This dual demand makes the restoration of the heritage structure a challenge, that is as interesting as necessary because of its vulnerability, since the search of the structural safety is critical for preservation, but even more for the human safeguard. In this sense the international deontological guidelines argue that the historic buildings require anamnesis, diagnosis, therapy and controls, specifying that prevention is always the best solution.

According to such purposes, this work concerns the acquiring process of the structural knowledge of a Seventeenth-Century church in Savigliano, a town in the province of Cuneo (Northern Italy), in which a finite element model has been built, after a process of documentation, as a support to a dynamic identification test.

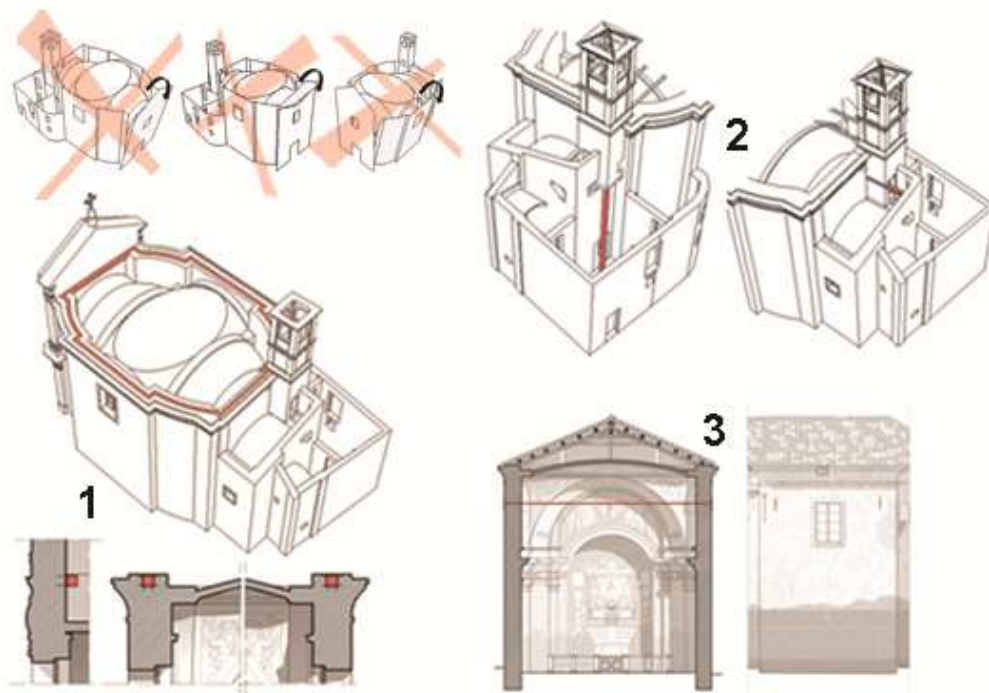


Documentation process

Then a numerical model-updating has been performed, downstream of such test, allowing to carry out realistic evaluations of the structural behavior that may suggest as well as verify some improvement interventions.



FEM modeling, dynamical tests, model updating and structural behavior analysis



Suggested improvement measures

As a consequence, the example of the Church of “Madonnina della Neve” contributed to point out how the cultural building heritage requires special attention, because of the intrinsic characteristics of the masonry, the construction defects, the irregularities, the effects of time, the deterioration or failures caused by the external forces: these properties make each of these buildings unique, but lead to higher degrees of complexity in interpreting the structural behavior; therefore the assessment has to be based on a knowledge path as thoroughly as possible, using a multi-disciplinary approach, in order to gather the largest number of data.

In this respect, dynamical tests have been confirmed as an efficient investigative tool: they allow to go back to the structural behavior of the building system as well as to its mechanical parameters with reduced costs and minimally invasive actions, which is important when the necessity to preserve the material integrity becomes truly significant. These techniques are employed as a diagnostic tool, finding hidden failures or other undetectable phenomena, and if the monitoring takes place under full operational conditions, it may constitute an alarm system without compromising the fruition of the building.

Finally the information that come out from the identification tests were employed to calibrate the preliminary numerical model by means of optimization techniques, since the deviation from the real behavior can be significant in cases where uncertainties are numerous. Then, the updated model was employed to make reliable evaluations of the structure behavior: as a matter of fact, the damages suffered by the Church in the course of time, aggravated by the induced vibration of the vehicular traffic, resulted in a significant reduction in the performance of some parts of the building, showing a disjointed reply among its macro-elements.

Then, for this reason, some improvement measures were proposed: they were designed to reconcile the preservation of the architectural identity with the practical needs of consolidation: introducing light and minimally invasive interventions is desirable, without modifying the ascertained structural function, in order to improve the performance of the building and, at the same time, not to compromise the character as well as the historical-artistic and cultural value.

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