

## THESIS ABSTRACT

Title: **GEOMETRY, ART AND CONSTRUCTION. CROSS VAULTS IN VALENCIAN KINGDOM DURING THE XIII-XVI CENTURIES.**

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The doctoral thesis document presented here approaches studies related to representative cross vaults from heritage buildings constructed after Jaume I king conquered the Valencian territory. The text focuses specifically on vaults ranging from the middle XIII century to the first years of the XVI century. The document contains a general exposure of all of the vaults to give a complete overview, but is focused particularly on the specific study of a selection of these elements.

Geometry, Art and Construction are the words that sum up the way the vaults of the period under study was conceived. Geometry and Construction were closely related from their first stages, being impossible the building of such vaults without the geometry and considered as a whole as an art. Many authors refer to it; Villard d'Honnecourt in his thirteenth century *Album* repeatedly writes "the art of geometry"; Viollet-le-Duc defines the term Construction in his *Dictionnaire raisonné de l'architecture française, du XI<sup>e</sup> au XV<sup>e</sup> siècle* in this way: "the building is a science; but also an art "; Father Tosca in his *Tratado de la monte y cortes de cantería*, that was edited in the early eighteenth century, directly called Arts, both the architecture and the stonework.

The analysis performed in this doctoral document focuses around the geometric and constructive concept of the vaults, which is, definitely, understood as an Art and, going further, putting all the elements in conjunction with its historical context, although the specific analysis of certain elements and concrete aspects focuses especially vaults built in the fifteenth century.

The exposed thesis has its origin in the work developed to obtain the *Master in architectural heritage conservation* certificate by the Universitat Politècnica de València. This master work named "Anastylosis of the architectural remains of the Valldigna monastery" was started at 1997 and publicly defended on March 3<sup>rd</sup>, 2000. To achieve the development of this study I did a research of the vaults architectonic remains found and fragments supposed to cover the cloister, refectory and the chapter house of the Santa María's Cistercian monastery, located at the village called Simat de la Valldigna, in the province of Valencia. For the work on that occasion, the architectonic remains were studied, but the research was directed basically on the star vault which covered the chapter hall before its overthrow. The main contribution of that work was the development of a research methodology of the missing Valencian ribbed vaults to allow the approach of a spatial geometry hypothesis that explains how they were built, from information derived from the representation of the architectural remains inventoried, but, that hypothesis based on the geometry was not absolutely assumed due to the finding of contradictory data after the analysis. The research stayed, then, opened for deeper further studies, which are approached in this doctoral thesis. The present document exposes a more detailed geometric analysis of the first results obtained in the master work, but now, using a variety of methods- both graphics and mathematics-, together with an study of the architecture, stonework and stereotomy treatises. Also, this study contains a comparative analysis with other contemporary cross vaults focused on their geometry and construction, but putting the spotlight in the comparison with another starry vault which covers the chapel

adjoining the hiring hall of the *Lonja de Valencia*, built at the same time (in the latest years of the XV century).

The previous document more closely related to the presented here, is the professor (and the director of the presented thesis) Juan Carlos Navarro Fajardo doctoral thesis: *Valencian cross vaults on XIV-XVI centuries. Trace and elevation*. Juan Carlos Navarro defended his thesis in 2004 at the Art History Department pertaining to the Geography and History Department of the Universitat de València. The scientific document redacted by Dr. Juan Navarro is an catalog detailing the gothic ribbed vaults of the age and territory. This doctoral thesis, from the existing framework, points specially in the architectonic research of star vaults pertaining to the late fifteenth century to achieve a geometric approach of its traces techniques, to gain insights about the geometric methods for the design of nerves templates and to do a geometric-constructive analysis of keys, of the springings and of the severies vaults studied in order to obtain spatial hypothesis of how they were thought and generated. Also, another issues are studied as the use of color in the vaults, the contextualization of the contemporaries stonecutters masters, the mason marks, etc.

The overall objective set from the outset was to be able to establish a methodology for graphic hypothesis of spatial geometry of missing ribbed vaults built in the period under review of any building or monument by the study of the elements that remained or were known, such as the segments that were part of the arches or ribs, springings or keys, together with the comparative study with other existing vaults built at the same time. And all this passes through the establishment of a methodology to hypothesize geometric and constructive generation of vaults feet from the analysis of the same elements.

These general objectives are developed from more specific partial objectives with which they come in a dialectical relationship, including:

- The typological classification of the different vaults constructed under the studied period and scope, in connection with the building typology they belong to;
- The study of cross vaults represented in a selection of manuscripts and treatises on architecture, stonework or stereotomy, mainly from the closest in time to the period under study, such as the sixteenth century, but also of later centuries;
- The architectonic documentation and inventory of the vaults under review and of the different elements that compose them (ribs, keys, springings, support elements and severies), from architectural surveys made by following the criteria of *La Carta del relieve* and methodologies of previous studies;
- Two-three dimensions scale representation of the elements composing the vaults under study and their spatial geometry, made by drafts on dwg files, through the generation of virtual three-dimensional reconstructions;
- Architectonic research from the documentation and representation of the elements composing the vaults with the objective to approach a deep metric, geometric, constructive and typological knowledge.
- Approach to how the master masons of the time think and conceive the vaults; working methods; mason marks, ...
- Approach to understand other issues or variables of the ribbed vaults under study such as the use of color through the comparison with other previously studied vaults currently existing or missing and with more examples reproduced in paintings, miniature models, etc, as well as with remains founded in some of the vaults.

The methodological rationale for the development of the doctoral thesis has been, thus, the architectural survey understood as is defined in *La Carta del relieve architettonico*.