

# THE USE OF SMART GEOMETRY IN ISLAMIC PATTERNS A GENERATIVE APPROACH TO THE RESTORATION OF THE ISLAMIC URBAN AREAS

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## INTRODUCTION:

Geometry is an essential design generator in the Islamic architectural style. Islamic styles are distinct for using the art of geometry in their creative designs. In the Islamic designs, geometry represents the order, harmony and beauty in **calculations**, scale and proportion. It clearly exists in the design of plans, façade, ornaments and patterns. It expresses many concepts of Islam such as the unity and the oneness of Allah, the perfection and the infinity of creation in the universe, the containments and the continuity. The main proportions of the Islamic style depend on the square proportions(ex: Islamic proportion  $1:\sqrt{2}$  (Williams, 2006), in which the square is the basic module shape that generates the other geometric forms such as the famous Islamic star, octagonal Islamic rose. In addition, square gives the basic axes and symmetry in the main internal spaces such as the Courtyard in the mosques. So far the role of geometry has been fundamentally dependent in which in it contains, regulates and supports the module of the elements.

Islamic geometry and proportions are following special shape grammar rules and relations which should be taken into consideration while the design process or the restoration of historical buildings. One can see the Islamic geometry simple in shape but precisely it is composed of a number of complex relations. And when the rules and the relations increase, the complexity in manipulating the geometry manually increases. That requires more time and effort to execute or modify. Therefore, parametric design strategies are employed to aid in solving this complexity. Parametric design develops the geometry to be more related and dependent. Consequently geometry is introduced in a new smart one.

In the traditional CAD software's, if one of the related geometries is deleted or changed, the modeled relationship may be lost. However, Smart geometry, as well as the parametric design, can convert lines, arcs, shapes, solids, and surfaces into a set of algebraic and geometric constraints that could easily generate those patterns according to a specific relations and proportions. Thus, a number of alternatives are presented to use the most suitable solution in a short time.

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