Geometry Analysis in Architecture of Vakil Mosque in Shiraz-Iran

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ABSTRACT
Vakil Mosque is of Zand era architecture (during the reign of Karim Khan Zand). This building has works including grille, tiling and plaster, Mogharnas, wide chamber with 48 stone columns seamlessly with spiral carving an so on, in Islamic geometry and this mosque is another expression of the Islamic-Iranian traditional architectural geometry with the purpose of expressing Throne of God on Earth. This paper aims to analyze the geometry of the building of the mosque by three types of software: Autocad, Skitch up, and Photoshop. In the end, we can understand the geometry (artistic style that before fractal geometry emerged in Iran with large differences) in Iranian architecture that is an expression of rhythm, reflection, and emphasis on the centrality of geometry in the traditional Iranian architecture.

KEYWORD
Vakil Mosque in Shiraz, geometrism, ornaments, arabesque, plant designs

INTRODUCTION
What can be gained from Shiraz Vakil Mosque is a perfect expression of Islamic art that is what in evident in Iranian traditional architecture such as rhythm, reflection, symmetry and naturalism.

RESEARCH OBJECTIVE
- We look for expressing the naturalism of Iranian traditional architectural geometry, a case study of Shiraz Vakil Mosque
- That is the geometry derived from Qur'anic verses and in Iranian art of traditional architecture such as tiling, Mogharnas, Shabak and masonry and plaster

RESEARCH QUESTIONS
What is geometry, which is evident in Iranian and Islamic architecture, founded on?
What meaning does geometry express in Islamic architecture?

INTRODUCING THE BUILDING
Vakil Mosque is in Shiraz from Zandieh period that has unique components including double entrance doors, height of 8 m and 3 m wide at each side, beautiful tiling over the mosque with Quranic verses written in Naskh on it, gilded inscriptions in Thulth at the arcade that has seven color tiles, the entrance roof leads to a corridor that has floral tiles on which in Kofi, it is written “La Illaha Alaallh” and “Ya Ali” (Picture 12).

In this shabistan, there are 48 monolithic stone columns with a height of 5 meters and diameter of 80 cm with arches that have spiral carvings in Zand style. Flooring of the shabistan are smooth slates and its plinth to a height of one meter and a half is flat and the ground is covered with Gandomak Marble and so on all of which will analytically be studied in this article.

RESEARCH LITERATURE
Regarding the analysis of geometry and architecture of the Vakil Mosque in Shiraz, no research has been done so far, and at the end, we will discover that naturalism is a symbol of the world hereafter something that is clearly seen in Iranian-Islamic art.

RESEARCH METHODOLOGY
Research type is qualitative based on (interviews, observation, mapping, field studies and library documents) and checks artistic and geometry components of the building of the mosque.

DATA ANALYSIS
All the designs and drawings are designed by Autocad & Google Skitch Up software.

GEOMETRY AND MATHEMATICS
Geometry is the word that Arabic-speaking scientists chose for Greek word “geometry” consisting of two parts: “Geo” meaning earth and “meter” meaning to measure the (Atlantic Highlands NJ, 1977, p.82). Muslim mathematicians respect the sanctity of mathematical science and had particular interest in it (Safa, 1977: 296).

This feature of math (geometry) is not that visible in any one of the Islamic sciences, but in Islamic art, it is vividly...
seen. Iranian art in Islamic era, besides being deeply Iranian
and in line with sensitivity of the Iranian people, in the
traditional sense of the word is Islamic too and can therefore
be used to show the link between universal spirituality
and Islamic art, the best way possible (Nasr, 1375: 8).

**GEOMETRY AND ARCHITECTURE**

Great architectural works have also occurred with the
help of the geometry (Shafaei, 2001: 2). The architectural
design is also shown in the form of geometry (Omoumi,
2008: 15). At all stages of the development of architecture, a
close connection is seen between geometry and building
material strength (Abolqasemi 2009: 366).

Position of the geometry in ancient architecture from the
old times has been so that Abualvafa Buzjani (330-380 AD)
used to hold meetings and scientific workshops in Baghdad
half of whose participants were architect and the other half
were mathematicians. In those sessions, by challenging
artists and mathematicians with common issues, he had
struggled to make a communication between the art and
mathematics (Brooke, 2008: 8).

**GEOMETRICAL NODE**

The variety of geometric shapes includes rectangular,
square, different kinds of diamond various forms, an endless
variety of different shapes of stars designed through
geometry, variety of grid designs using geometric principles,
maze and lots of circles that all seem to represent the most
surprising power of innovation and imagination (Derek Hill
and Oleg Grabar, Islamic architecture and decoration,
translated by M. Vahdati Daneshmand, Tehran, scientific

![Fig.1. Circulation of khataei flowers among arabesque patterns](image1)

![Fig.2. The geometry used in Mogharnas](image2)

Geometry used in Mogharnas of the building of Vakil
Mosque, Shiraz that is a combination of fractal geometry
(geometry that arose after the Iranian Islamic art, here we
just look at geometry based on mathematics, because the
fractal geometry is not old compared to architecture based
on mathematics) and naturalism including flowers sepals
that appear slumped at the top Mogharnas.

![Fig.3. (expression of the geometry 1 from Fig. 1)](image3)

![Fig.4. Mogharnas idea is from bee nest, which is another word of naturalist nature of geometry in Islamic architecture.](image4)

![Fig.5. Grille used in the building that shows inspiration from nature and prosperity of the flowers](image5)

**GEOMETRY**

This is of the most basic methods of exposure and based
on the amount of light that is to enter the building is made in
different sizes. Windows are made for light, airflow, and to
see the landscapes without disrupting the interior quiet. In
areas where sunlight is intense, grille doors and windows a
balance of light outside and inside: a balance that prevents
the sunlight and prevents eyes’ getting tired against the
bright sunlight. Thus, designs used in the making of these
elements are in such a way that adjusts the light in the room
Three-dimensional geometry of Picture 5

GEOMETRY USED IN CHINA KNOT OF THE TILING:

Ten Edged Shamseh (shining sun)
In Akhavan Alsafo’s book, conduct stages are perceived to be in ten stages and for each time there are ten features (See. Laleh Bakhtiar, Sufi, London, Ibid, PP 97-102). Khajeh Abdullah has found ten verses for each one of ten conducts and has made them clear. (Ansari-al-Haravi, Abdollah, LesEtapesdesItinerents Vers Dieil, Troms s. De Lougier Beau recueil, Paris).

SYMMETRY AND REFLECTION
What can be known is that geometry in Iranian architecture can be realized based on symmetry, rhythm, and reflection.

ARABESQUE
Arabesque includes circles and repetitive circular mazes, often symmetrical and at times asymmetrical that can be a reminder of the twisting of stems of plants. Arabesque with its various turns methods has a basic role in the decorative motifs of Iran. Arabesque designs are inspired by the plants and it the use of the purest natural phenomenon that has been filtered through the artist’s mind. Arabesques are connected with some nodes in a very technical and elaborate way called “Arabesque Node.” In addition, arabesque nodes take the monotony of binding loops, take their boredom, and give them another atmosphere. (Hossein Ali Machiani, Teaching gilding, former, pp. 14-13). Arabesque designs can be found in the arts such as tiling, carpet weaving, painting art so on in Iran.

Fig.9. Arabesque used in Islamic Art Designs used in geometry 2 from Fig 2

Fig.10. Geometry used in china nodes of Vakil Mosque building

Fig.11. The geometry of plaster ornament in the plinth
These beautiful nodes in tiles decorations work are well applicable. One of the examples in the collection of Sheikh Safi is the seven color tiles of the plinth of the Chini Khaneh (house of porcelain). Chini Khaneh, which is located in the east of the tomb, is a building almost octagonal dedicated to take care of exquisite porcelain Safavid kings allocated to their ancestors' tombs (MY Kiani, history of architecture in the Islamic period, P. Yeshin, p 167).

**SHABISTAN**

Fig. 12. Rhythm and emphasis on the centrality in the South Shabistan of Vakil Mosque

Fig. 13. Vakil Mosque shabistan in Shiraz with Kufic script writing La Ilaha Alaallh and Ya Ali

Fig. 14. The geometry on the dome of Vakil Mosque facade seeking expression of Imam Ali (PBUH) in the body of the tile work

**CONCLUSIONS:**

All that can be realized about Architecture of Iran from Shiraz Vakil Mosque is that Iranian Architecture follows to express rhythm, emphasizing centrality, reflection, and expressing mathematical geometry (geometry that had emerged before fractal geometry in Iran)- Arabesque reliefs in Iranian Architecture all of which are after stating that the Islamic-Iranian architecture is nature oriented.

**LIST OF PICTURES**

Fig. 1, 2, 3, 4, 5, 6 and 7: author

Fig. 8: Cultural Heritage and Tourism Organization of Iran

Fig. 9, 10, 11, 12, 13, 14 and 15: the author

Fig. 16: Cultural Heritage and Tourism Organization of Iran with author's editing

**REFERENCES**


