Analysis of the Geometric Decorations of the Stone Half-Columns of the Friday Mosque of Isfahan

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Abstract

The Jame Mosque of Isfahan, located almost in the center of Iran, displays ornamentation from early the Islamic centuries until the 13th century AD. We introduce and analyze unique stone decorations found in this mosque. This article presents constructions for the geometric decorations and floral motifs of five half-columns found in this magnificent structure.

Introduction

For centuries, mosques were the main production centers of Islamic culture. Mosques are not only the physical manifestation of the true sign of the evolution of Islamic architecture, they also serve as the foundations of religious, scientific, political, and social life. A vivid example of this claim can be found in Jame Mosque of Isfahan.

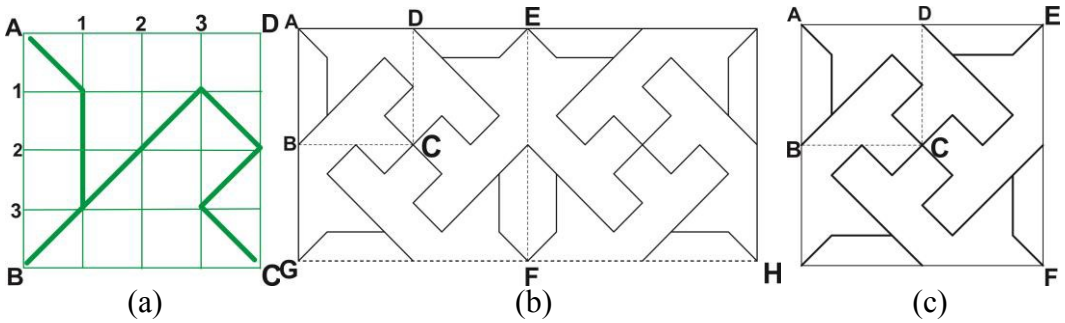
Jame Mosque of Isfahan is great example of traditional architecture in Iran over centuries after Islamization. Of course, it is indebted to the rich history and the architectural knowledge of the previous periods. The present mosque is the result of changes that took place during thirteen centuries, and of course there are different types and examples of detailed decorating tiles, brickworks, and stones remaining from each period. This mosque has a central courtyard that expands and is integrated with the surrounding city. Separate elements are related to the building of a relatively independent school in the 8th century AD. There has been considerable discussion about the chronology of the evolution of the mosque. Regardless of the probability related to the pre-Islamic remnants of the Islamic era belonging to 3rd century AD to 13th, we believe that there is the central part of almost the same architecture in 6th or 8th century AD, but without decorative scheme. However, the main point is that this mosque is presently a complex mixture of composition [1]. In Jame Mosque of Isfahan, there are several sectors that were made during various periods.

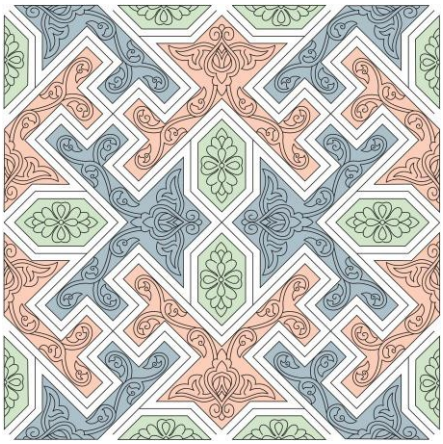
The stone decorations discussed in this article are located at the height of 1–1.5m below the peripheral walls of the mosque. These decorations are called *plinth* (ezareh). In traditional Iranian architecture, their shape forms a half-column. There are total of 52 half-columns with floral or geometric designs, and sometimes a combination of both; the geometric designs of five of these half-columns of the mosque are considered here because they are more complex than other decorative stones of the mosque and are not repeated in the structure; moreover, there is a way to draw them according to geometric rules. The girih is a product of precise geometric divisions based on basic geometric shapes such as circles, squares, etc., which is used by current rules of mathematics and is designed with different artistic techniques according to its place of usage. The aim of this article is to introduce these beautifully complex divisions and to show their method of construction in this majestic building.

Construction Technique for the Geometric Girih of Half-Column 1

Half-column 1 is shown in Figure 1. The directions that follow accompany the diagrams in Figure 2. These steps are followed: Square ABCD is drawn, and each side is divided into four parts and named. Point A is connected to point (1, 1), then point (1, 3). Point B is connected to points (3, 1), (D, 2), (3, 3), and C according to Figure 2(a). The resulting connection lines can be rotated about the point C through an angle of 90°. Three repeats make Figure 2(b), which is the overall design of the girih. Figure 2(b) is reflected through axis EF to make Figure 2(c). Figure 2(c) is reflected through axis GH to make Figure 2(d). The girih of half-column 1 is made by repeating the reflection of Figure 2(d). In the girih of half-column 1, the floral design is repeated in Figure 2(e).

Figure 1: *Half-column 1*





(d)

(e)

Figure 2: *Construction technique for the geometric girih of half-column 1*

Construction Technique for the Geometric Girih of Half-Column 2

Half-column 2 is shown in Figure 3. The directions that follow accompany the diagrams in Figure 4. These steps are followed: Draw line AB, draw a line perpendicular to line AB at points A and B. Point A is separated at a 30° angle to cut the line perpendicular to point B at point D. This step is repeated from point B to achieve point C. Draw line DC and repeat the previous step for points D and C to obtain points F and E. Repeat the previous step for FE line to get points G and H. Diameters of rectangles ABCD, CDEF, and EFGH are drawn and the center of the rectangle is defined with O, O', and O". Point A is connected to points O, O", and H, one after another. Point F is connected to point D according to Figure 4(a). Figure 4(b) is reflected from BH three times to achieve Figure 4(c). Repeating this design, Figure 4(d) is obtained. In the girih of half-column 2, the floral design of Figure 4(e) is repeated.

Figure 3: *Half-column 2*

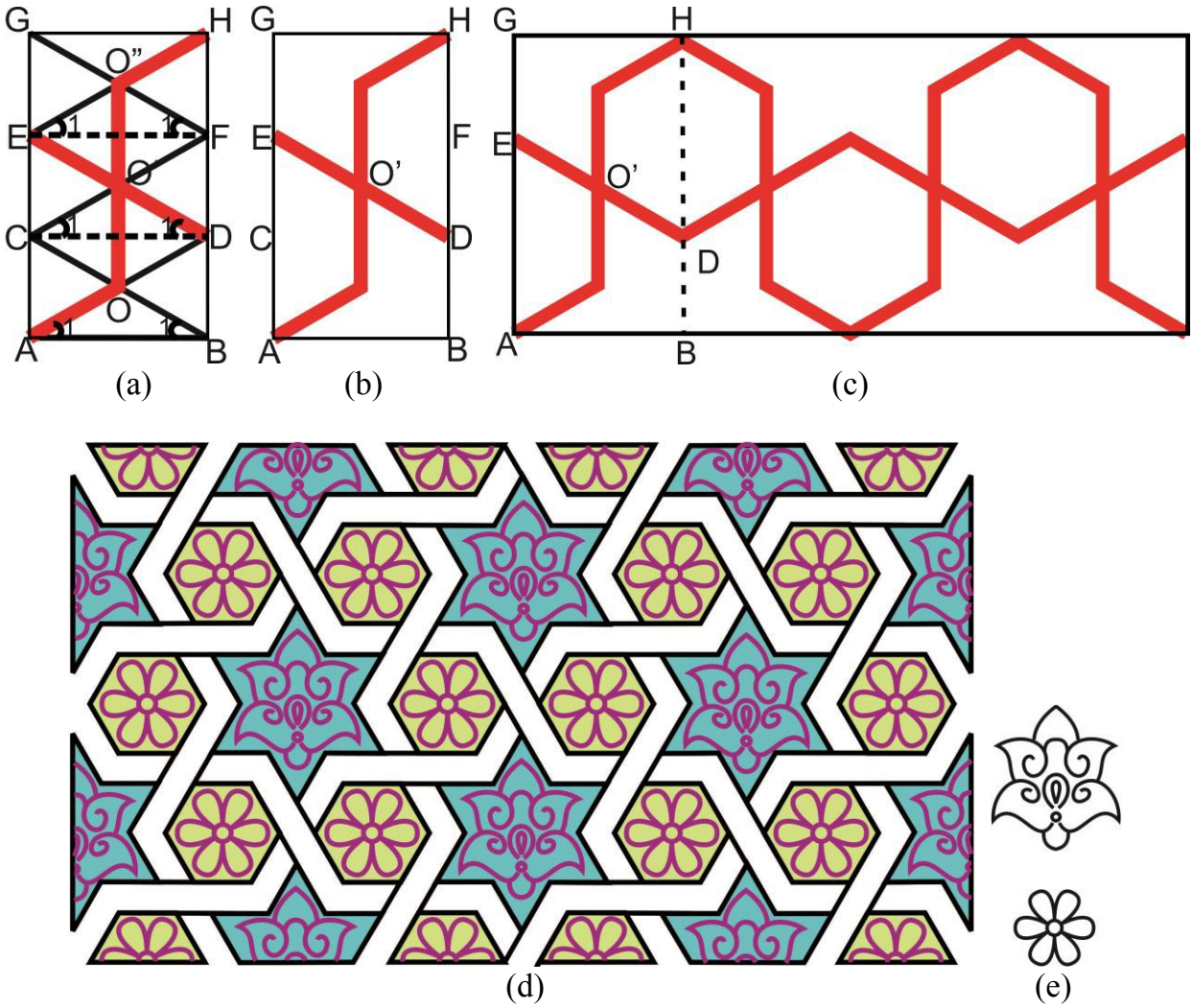


Figure 4: *Construction technique for the geometric girih of half-column 2*

Construction Technique for the Geometric Girih of Half-Column 3

Half-column 3 is shown in Figure 5. The directions that follow accompany the diagrams in Figure 6. These steps are followed: Square ABCD is drawn and each side is divided into three parts and named according to Figure 6(a). Squares EFGH and IJKL are drawn (Figure 6(a)). Each side of square EFGH is divided into four equal parts and named, and the connection points are obtained according to Figure 6(b). The intersection point of side LI and side HE is named point Z; the intersection point of side IJ and side EF is named point P; the intersection point of side JK and side EG is named point X; the intersection point of side HG and side KL is named point Y. The matching center of each three square is named point O (Figure 6(b)). Point E is connected to points (3,0), (3,1), (2,1), O, (2,3), (1,3), (1,4), and G; point F is connected to points (0,1), (1,1), (1,2), O, (3,2), 3,3), (4,3), and H; point Z is connected to point L, point I is connected to point P, point J to point X, and point K is connected to point Y (Figure 6(c)). Figure 6(c) is reflected across BC. The original and its reflection are then both reflected across DD′ to obtain Figure 6(d). Figure 6(d) is repeated to achieve the girih of half-column 3 (Figure 6(e)). In the girih of half-column 3, the floral design of Figure 6(f) is repeated.

Figure 5: *Half-column 3*

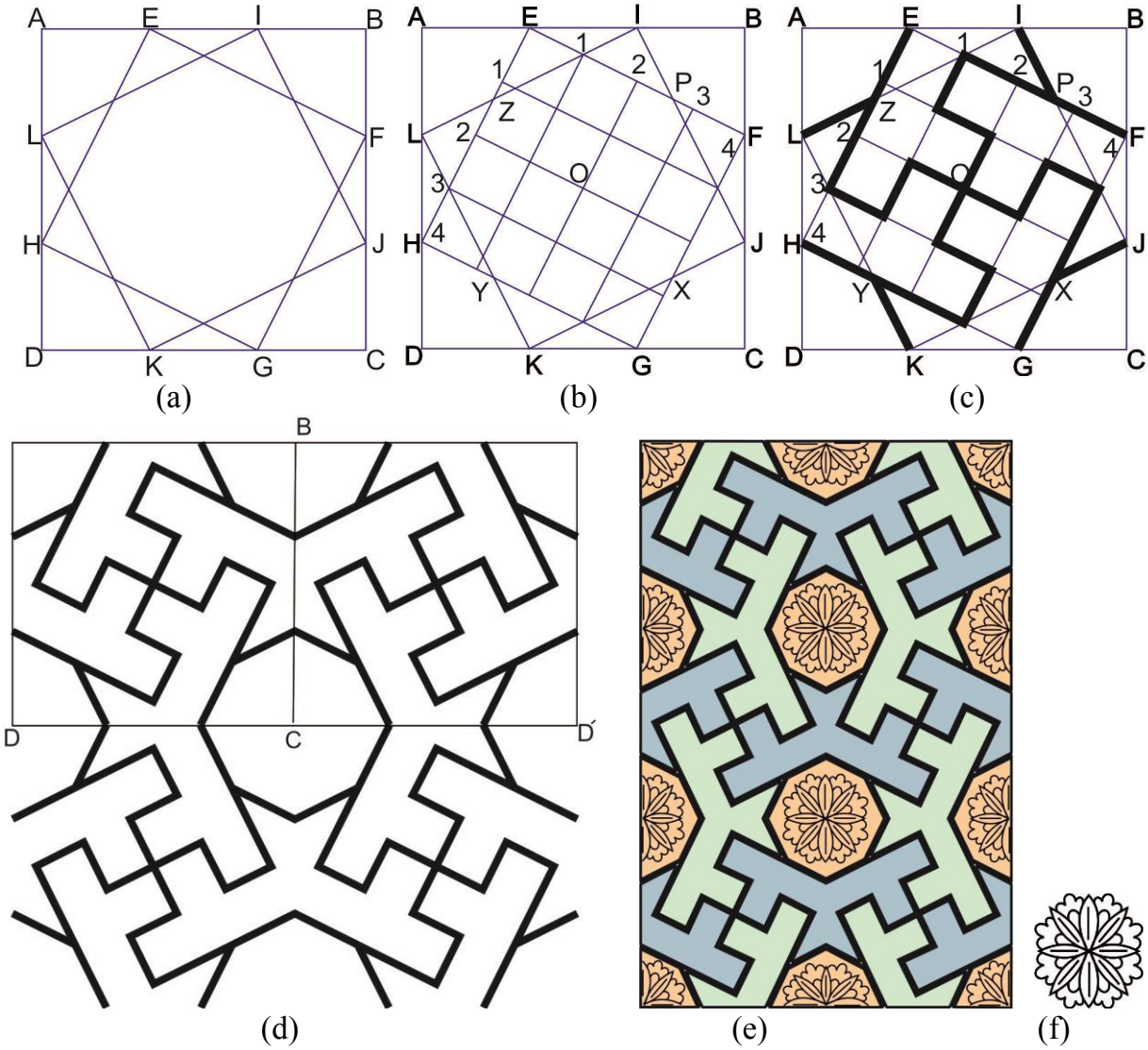


Figure 6: *Construction technique for the geometric girih of half-column 3*

Construction Technique for the Geometric Girih of Half-Column 4

Half-column 4 is shown in Figure 7. The directions that follow accompany the diagrams in Figure 8. These steps are followed: Square ABCD is drawn, and each side is divided into three parts as in Figure 8(a). And again each side is divided into two parts and named according to Figure 8(b). According to Figure 8(c), point O is connected to point 2 on AB side; point O is connected to point 2 on AD side; point O is connected to point 3 on BC side, point O is connected to point 1 on CD side. Figure 8(d) is reflected across BC to form Figure 8(e). Figure 8(e) is reflected across DD′ to form Figure 8(f). Figure 8(f) is repeated to achieve the girih of half-column 4 (Figure 8(g)). In the girih of half-column 4, the floral design of Figure 8(h) is repeated.

Figure 7: *Half-column 4*

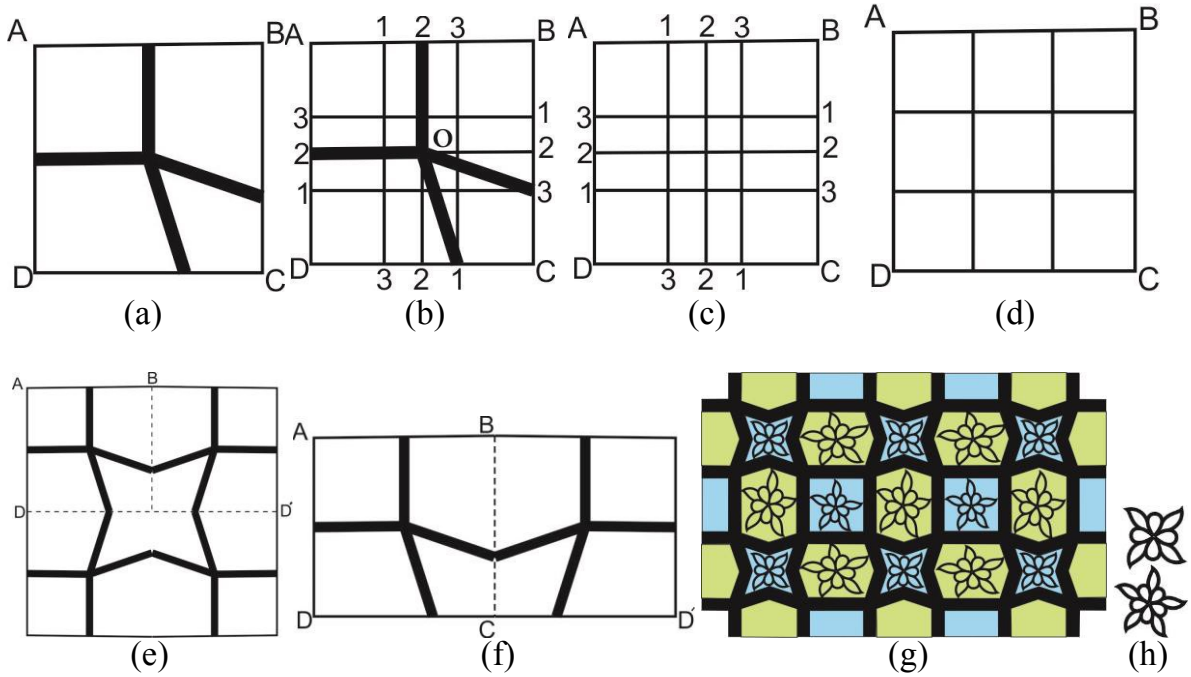
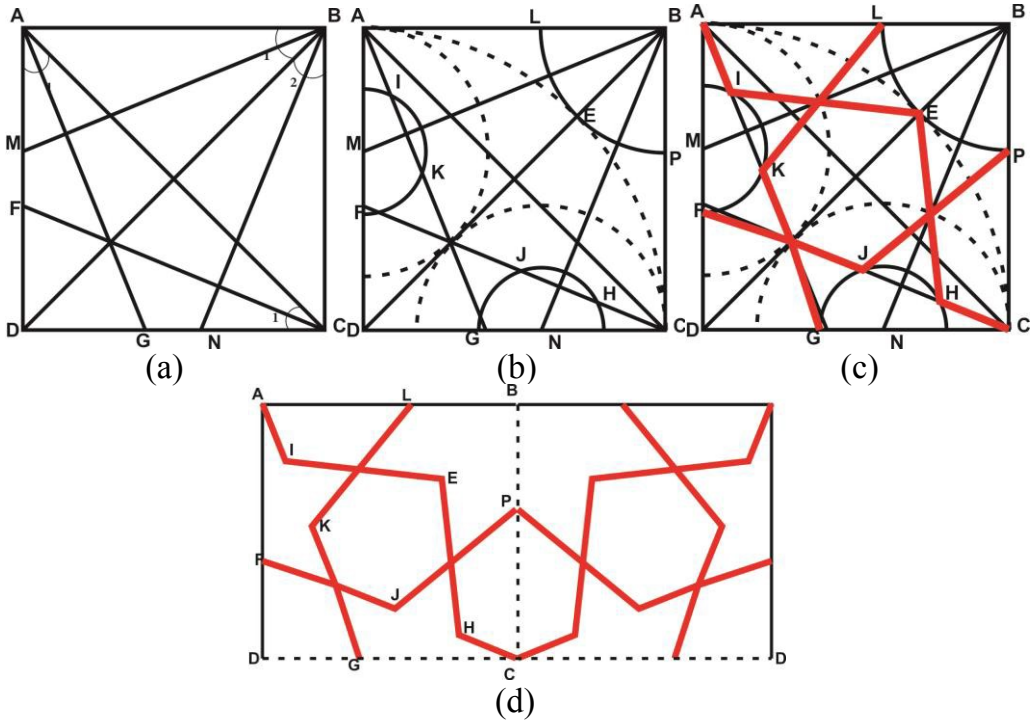


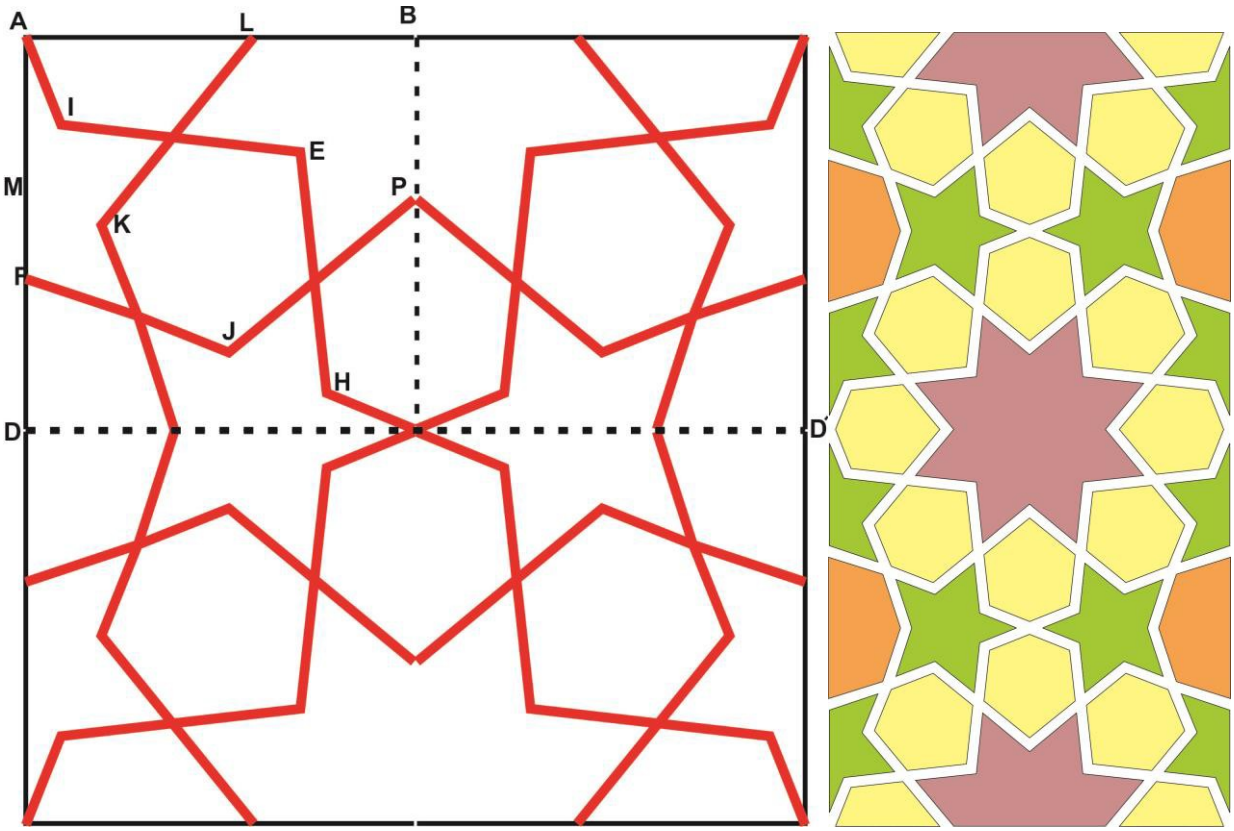
Figure 8: *Construction technique for the geometric girih of half-column 4*

Construction Technique for the Geometric Girih of Half-Column 5

Half-column 5 is shown in Figure 9. The directions that follow accompany the diagrams in Figure 10. These steps are followed: Draw a square ABCD, draw the square diagonals, angle bisectors A_1, B_1, B_2, and C_1, and the name the resulting points as in Figure 10(a). An arc of radius DC is drawn from center D, and the intersection point of this arc on diameter BC is called E. The arc of radius BE is drawn from center B. The arc of radius (1/2) BE is drawn from centers M and N, and the resulting points of intersection with the angle bisectors are named in Figure 10(b). Point A is connected to points I, E, H, and C; point F is connected to points J and P; point G is connected to points K and L as shown in Figure 10(c). Figure 10(c) is reflected across BC to form Figure 10(d). Figure 10(d) is reflected across DD′ to form Figure 10(e). Figure 10(e) is repeated to achieve the girih of half-column 5, as shown in Figure 10(f).

Figure 9: *Half-column 5*





(e) (f)

Figure 10: *Construction technique for the geometric girih of half-column 5*

Conclusion

In this paper the geometric decorations of stone half-columns in Jame Mosque of Isfahan have been analyzed. The mosque is a magnificent example of the rich history of Islamic architecture in Iran, and there are examples of architecture and decorating types from each period that have been made with different techniques. The stone ornaments discussed here are examples of these unique decorations. The craftsmen applied creative and unique forms of design in the ornaments, of which many parts have been destroyed. Therefore, this paper is an attempt to detect design methods for preservation purposes and also for the presentation of the prominent features of this structure. The building has numerous stone ornaments with many decorations, and the half-columns are of the most diverse geometric designs in conjunction with floral designs. Some of these designs result from simple construction techniques like that of half-column 4, and some need more sophisticated methods such as those of column 5, which are used to locate the designs beautifully and coherently on the curved form of the half-columns. In future works, this construction technique will be fully explained by geometric dividing and other mathematical methods.

References

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