GEOMETRIC PATTERNS AS A FORM-GENERATING PRINCIPLE IN ARCHITECTURE

Saipova Madina Saidakhbor qizi
Dotsent, Department of Architecture and Digital Technologies,
Tashkent International University of Management and Technologies,
PhD in Architecture
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Abstract

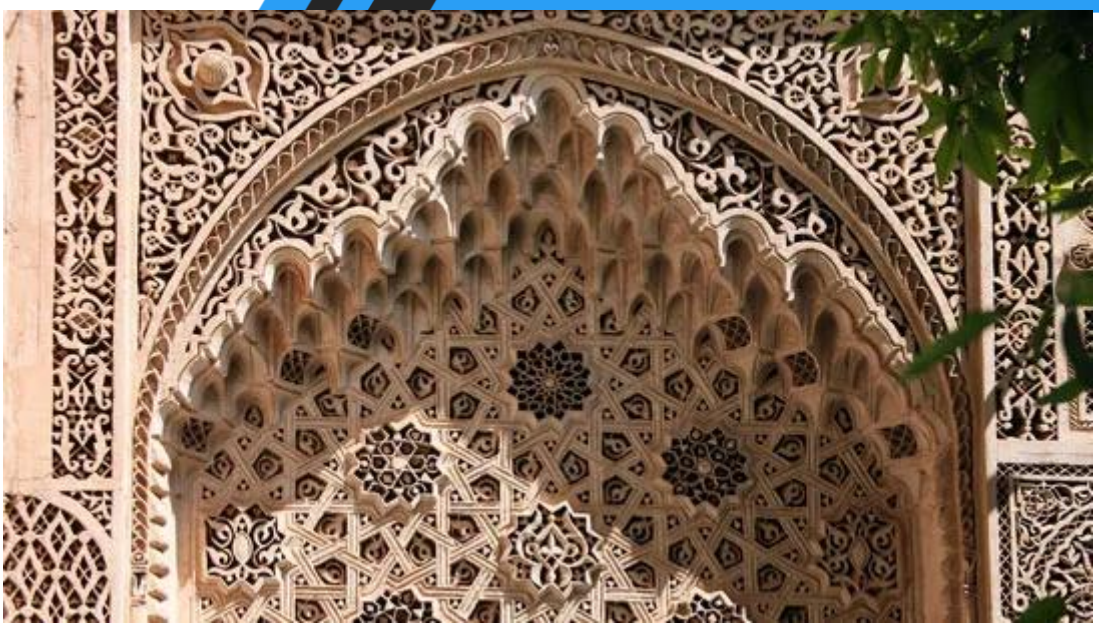
This article explores geometric patterns as a fundamental form-generating and meaning-bearing principle in architecture. Rather than viewing ornament as superficial decoration, the study interprets geometry as a structural and conceptual system that shapes spatial organization, proportion, and aesthetic expression. Special attention is given to the architectural heritage of Central Asia, where intricate polygonal networks, star configurations, and interlacing compositions became central to artistic identity. Through selected historical examples, the paper demonstrates how geometric order reflects cosmological ideas, intellectual traditions, and the search for harmony between structure and symbolism.

Keywords: geometric patterns, architectural form, girih system, spatial composition, Islamic architecture, Central Asia, proportional order, ornament and structure, symbolism.

Introduction. Geometry has long served as one of the primary languages of architecture. Across civilizations, mathematical order provided architects with tools to organize space, establish proportion, and communicate philosophical ideas. Geometric systems are not merely decorative additions; they structure perception, define rhythm, and articulate relationships between parts and the whole.

In Islamic architectural traditions, geometry assumed particular importance. The development of complex interlacing patterns and star polygons was closely connected to advances in mathematics and astronomy. These patterns conveyed a worldview based on unity, infinity, and the coherence of the cosmos, transforming buildings into symbolic representations of universal order.

Basic geometric forms—circles, squares, and polygons—serve as organizing principles in architectural planning. The circle often symbolizes unity and totality, while the square represents stability and the earthly realm. When combined, these forms generate harmonious compositions that reflect the interaction between heaven and earth.



The circular plan of Koy-Krylgan-kala demonstrates how geometry structured not only ornament but also spatial configuration. The monument's layout suggests a cosmological model, where architecture becomes a microcosm of the universe.

One of the most sophisticated expressions of geometric thinking in architecture is the girih system—an arrangement of interlocking polygons that creates visually continuous surfaces. These networks often incorporate multi-pointed stars, symbolizing multiplicity within unity.

The façade of Ulugbek Madrasah offers a refined example of such geometric articulation. The carefully calculated star patterns and tessellations demonstrate the integration of scientific knowledge and artistic mastery. Ornament here functions as a visual manifestation of intellectual culture.

Similarly, in the Poi Kalon Complex, geometric repetition enhances monumentality. The rhythmic arrangement of polygons and stars creates a sense of continuity, guiding the viewer's perception across architectural surfaces.

Geometric patterns are closely aligned with architectural structure. In domes, radial compositions emphasize centrality, visually reinforcing the structural logic of weight distribution. Arches and vaults rely on geometric precision for stability, while surface decoration often mirrors these structural frameworks.

The interior of Gur-e Amir illustrates how ornamental geometry complements spatial hierarchy. The dome's decorative network radiates from a central point, reinforcing the symbolic idea of unity and transcendence while echoing the structural form.

Thus, geometry acts simultaneously as structural necessity and symbolic language, bridging engineering and metaphysics.

Modern architectural practice continues to draw inspiration from historical geometric systems. Digital modeling tools and parametric design allow architects to reinterpret traditional polygonal networks with new materials and technologies. Contemporary façades, screens, and spatial installations frequently reference classical geometric logic while adapting it to present-day contexts.

This continuity demonstrates that geometric ornament remains a dynamic and evolving component of architectural expression rather than a relic of the past.

Conclusion. Geometric patterns function in architecture as both structural frameworks and carriers of symbolic meaning. In the architectural heritage of Central Asia, complex polygonal and star-based systems achieved exceptional refinement, reflecting mathematical knowledge and cosmological thought.

By integrating ornament with spatial and structural logic, geometry transforms buildings into coherent, meaningful environments. Understanding geometric patterns as generative principles rather than surface decoration allows for a deeper appreciation of architectural heritage and its relevance to contemporary design.

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