Shakhboz Mustafoev

Tashkent Univercity of Architecture and Civil Engineering: TUACE,
Faculty of Architecture, Department of History and Theory Architecture, Tashkent,
Uzbekistan.

EVOLUTION, GEOMETRIC ANALYSIS AND CLASSIFICATION OF MUQARNAS IN UZBEKISTAN (9th-14th centuries)

Summary: *The research is devoted to the evolutionary development of stalactites in Uzbekistan of the 9th -14th centuries - a square-rhomboid type. Features of these stalactites from other types, methods of geometric analysis based on the methods of architect masters and archival materials. In addition, the article indicates some mistakes of restorers in the design and reconstruction of this type of stalactite.*

Keywords: *Muqarnas, Tahbin, Squinch, Shamseh, Taseh, Toranj, Tee, Espar, Takht, Shaparak*

INTRODUCTION

Investigating of stalactites of Central Asia during the period of 9th -14th centuries is represents particular interest: there were intensive development of terracotta-glazed block stalactites took place, during this period, which exhausts itself only end of the 14th century. Furthermore, we could see the appearance of *ganch* (Zoxidov, 1996, p-19) and *mosaic* variations of stalactites and a changing their constructing method of a *square-rhomboid type* to a pole *table type* (Hamidreza, 2016. pp. 35-36). Complex as *Shah-i-Zinda* in *Samarkand* could be serve as excellent example of the location of architectural objects, which allows us to trace the line of evolution of a *square-rhomboid type* of stalactites in this period.

Architectural scrolls of 14th century made by Bukharian masters, as well as late (20th- early 20th centuries) architectural scrolls, etc. (“Bukhara scroll”, inv. №: 4429/16, № 4430/16, № 4174 - № 4180), made by Uzbek and foreign artisans (“Tashkent scroll”, doc. №1 - №7), reflect only the most important key of *muqarnassaze(traditional school of constructing*

stalactites) - the *Tahbins* (2D plans of muqarnas) shows hidden main lines of stalactites and creation methods.

The method of successive construction of stalactites, deployed from the general to the particular, to the geometric elements that make them up, was kept as secret as possible by the Ustozodas (qualified artisan) for many centuries, and knowledge was transferred only to students who were worthy of this knowledge. If we analyze the scrolls of Bukharian masters, we could notice hypothetically the construction of stalactites for the 19th and early 20th centuries originated from stalactites of the 16th-17th centuries. They originated mixed type, but for the 9th- 14th centuries, characteristically used massive blocks. For example of the mausoleums of the Shakhi-Zinda ensemble, we could be sure that the harmonious, logical system for constructing terracotta stalactites was different - a square- rhombus shaped type [Table 1; 2.].

Subheading

In this study, the analysis of the solution of each plan of stalactites of the mausoleums from Central Asia such as Samarkand, Kune Urgench and Nukus is presented in four stages.

1. Beam grid (departing from the center of Shamseh - Nayzagi);

2. Geometric basis - "girih" figurative polygonal geometry;

3. Analysis - projection of series;

4. Typology of building blocks.

In this sequence, attention seems to linger on the most important, key moments of the project.

The key that opens the mechanism for constructing this type of stalactites can be seen in the example of stalactites (*sharafa*-stalactite frieze) of the mausoleum of Najmeddin Kubra (30s of the 14th century), which is as follows: forming in terms of square and rhombus figures, which can be converted from an octagon by drawing ray lines. Since these squares and

rhombuses were constructed from the rhythmic divisions of the octagon. From this, it follows that the rhombus is 45°, and the square is 90° [Fig. 1].

Thus, the first operation to decipher this kind of stalactites is to find the *taqsim* (repeating part of drawing) and the dominant figure in the center of this *taqsim*, which begins the first row of stalactites. It should be noted that in *sharafas*, the dominant figure is usually the lower part of the decor and grows to the top, while in muqarnas they are, on the contrary, down.

The second operation is to build up a drawing consisting of polygons from the plane of the wall, that is, it is necessary to break large polygons into small polygons like a rhombus and a square. We conditionally called this stage the geometric analysis of "*girih*" shaped planes. The construction of the “girikh's” perspective, unlike the classical planar one, is not limited to two options, and, having mastered it as a geometric density and following one nature, you can accurately “stick” the pattern of the entire stalactite ceiling (that is, in this case, the restorer or architect can serve polygons based on your skills and working out variations)(Notkin, 1970, p. 241). An example of our hypothesis is the work of I.I. Notkin and the geometric analysis of the author, on the construction of stalactites in the mausoleum of Kusam-ibn-Abbas in Shakhi-Zinda, Samarkand. [Fig. 2; 3,].

If we compare the *Tahbin* stalactites from the mausoleums of Shakhi-Zinda, it is easy to see that all of them consist of the same rhythmically repeating elements like rhombuses and squares.

In the first stage of the analysis, as in the previous stalactite, it is necessary to draw ray lines. In this regard, it can be assumed that the master, creating a new original stalactite Squinch, mentally, as it were, join together three octagons along the ray lines and rhythmically projecting them together, establishes their relationship.

In the second stage, by dividing the main octagonal planes, as in the previous example, new polygonal blocks can be formed on the basis of the main polygon, which redirected towards Shamse. The master must consider, carefully observe, and check the dynamics of the

geometry in this stage, in the extreme case, the master in the third stage may encounter a problem such as determining the location of *Takhts*.

This phenomenon can explain the evolutionary development of this type of stalactite. Gradually, not only structural, but also large-scale grinding of stalactites occurs. A clear confirmation of the fact is the stalactites of the corner sails located in chronological sequence and conditionally in the same dimensions in the mausoleums of Mane Baba (11th c.) Arslan - II (Fakhreddin Razi 12th c.), Mazlumkhan-Sulu (14th c.), Kusam-ibn-Abbas (12th -14th c.), master Ali Nesefi (12th-14th c.) [Fig. 4].

In the third stage, it is better to emphasize individual parts of *Takhts*. If you do not take into account these lines and do not pay attention to them, you can mistakenly spoil the stalactite in the restoration process. That is, the master mistakenly can mix two separate rows of stalactite [As in Figure-3, III]. Such a gross mistake is considered unacceptable for the restoration of cultural heritage. In addition, in the same figure, the shortcomings of the stalactite components are noticeable as: *Kosagi* (type of *Taseh*), Type of *Poyagi* (also Geese feet, *Madani*) especially in the first, second and third rows.

Therefore, before starting the restoration of such stalactites, it is first of all necessary to learn the typology of the constituent blocks. The works of masters such as Al-Kashi, Usta Lorzade and others can serve as a clear consequence [Table 3].

The simplicity of building a grid of identical elements is obvious. At the same time, this type of muqarnas contains unlimited possibilities for development and application. Based on squares and rhombuses, we can create hundreds of pattern combinations, fragments of this geometric motif by using in building plans for stalactite vaults, arched sails, cornices, capitals, etc.

The versatility of polygons once again emphasizes its remarkable qualities: with a limited number of type elements [Table 3. The main elements of Al-Kashi muqarnas according to Harmsen, 2006], you can create a variety of three-dimensional compositions. The discovery

of the internal reserves of this system of construction, in our opinion, is far from being exhausted.

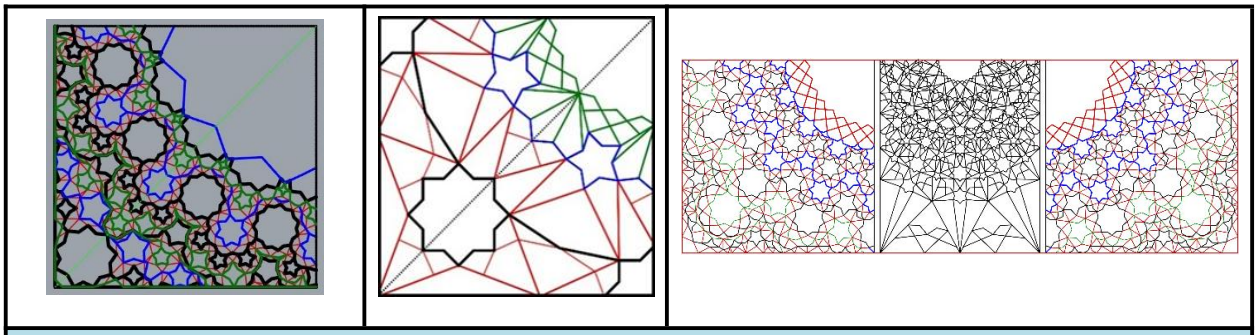
CONCLUSION and EVALUATION

Based on our research, we can say that in the 9th - 14th centuries in Uzbekistan, the dominant type of stalactites was a square-rhomboid type; the structure of this type of stalactites was based on large polygons like an octagon. Based on our investigations and drawings of Bukharin masters, we could claim that initially they originated from Squinchs and gradually developed, the polygonal planes and divided them into rhomboids and square-shaped figures. But the development of building materials like ganch and the confluence of Iranian methods of building stalactites negatively influenced the development of this type.

With regard to the characteristics of the stalactites of this period: terracotta blocks based on geometric figures form squares and rhombuses in various combinations. Their sides are the same length. Graphic construction, as in cornice stalactites, begins with the walls. The ganch stalactites are characterized by a radial-beam articulation system, the construction of which begins from the top of the vault. The plasticity of terracotta stalactites becomes more fractional; in the corner sails, the sizes of the blocks are reduced, the number of flat elements in the niches of the portal increases. At first, terracotta stalactites are not connected with the vault, then gradually the outlines of the stalactite vault approach the bend of the lancet vault. This task is performed only in ganch and mosaic stalactites.

FIGURES and TABLES

CLASSIFICATION OF MUKARNAS (Based of Sh.Sh. Mustafoev)		
I. Muqarnas	II. Iroqi	III. “Chorzamin” (Mixed type)



“Daftari Girih” Tashkent 2/1. Photo source by SH. Mustafoev

Table 1. Evolution of Muqarnas in Uzbekistan

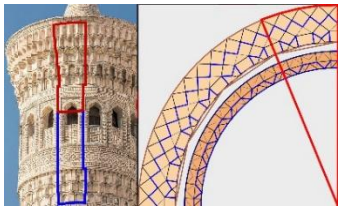
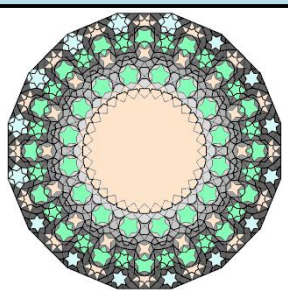
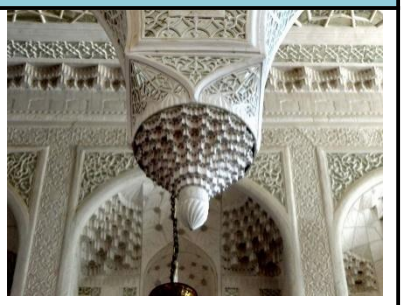
TYPES OF MUQARNAS (Based of Sh.Sh. Mustafoev)		
1. Square rhombus shaped type	**2. Pole table type**	**3. Other type (Aviz)**
		
Kalyan Minaret (XII c., Bukhara)	**Geometric analysis of cupala, Based of Usta Shirin Murodov.**	**Sitorai Mohi Khosa (XIX c., Bukhara)**

Table 2. Evolution of Muqarnas based on architectural scrolls and artefacts.

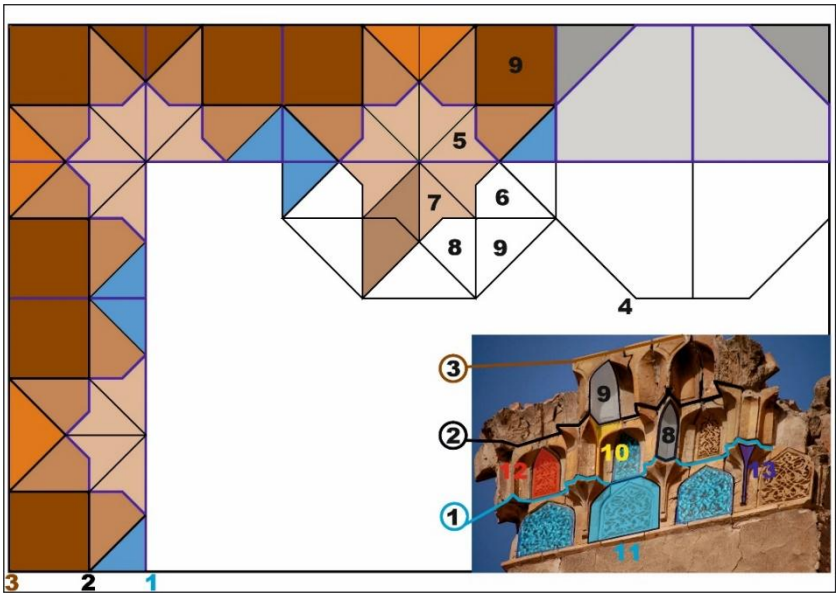


Fig. 1. Scheme of construction of a stalactite cornice in the mausoleum of Najmeddin Kubra (XIV century) in Kunya-Urgench by Sh. Mustafoev.

Etymological terms of the constituent parts of muqarnas1; 2; 3 – Takht. 5 – Part of Takht. 6; 8; 9; 12 – Kosagi (type of Taseh). 7; 13; 10 –G'ozpoya (Type of Poyagi also Geese feet, Madani). 11 – Kosacha (Espar)

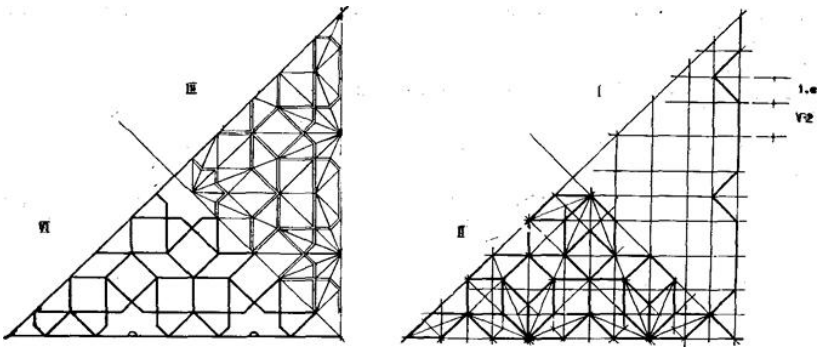


Fig 2. Construction of stalactites in the ziarat-khan of the mausoleum of Kusam-ibn-Abbas (1335). Corner Squinch. Sourse by I. I. Notkin

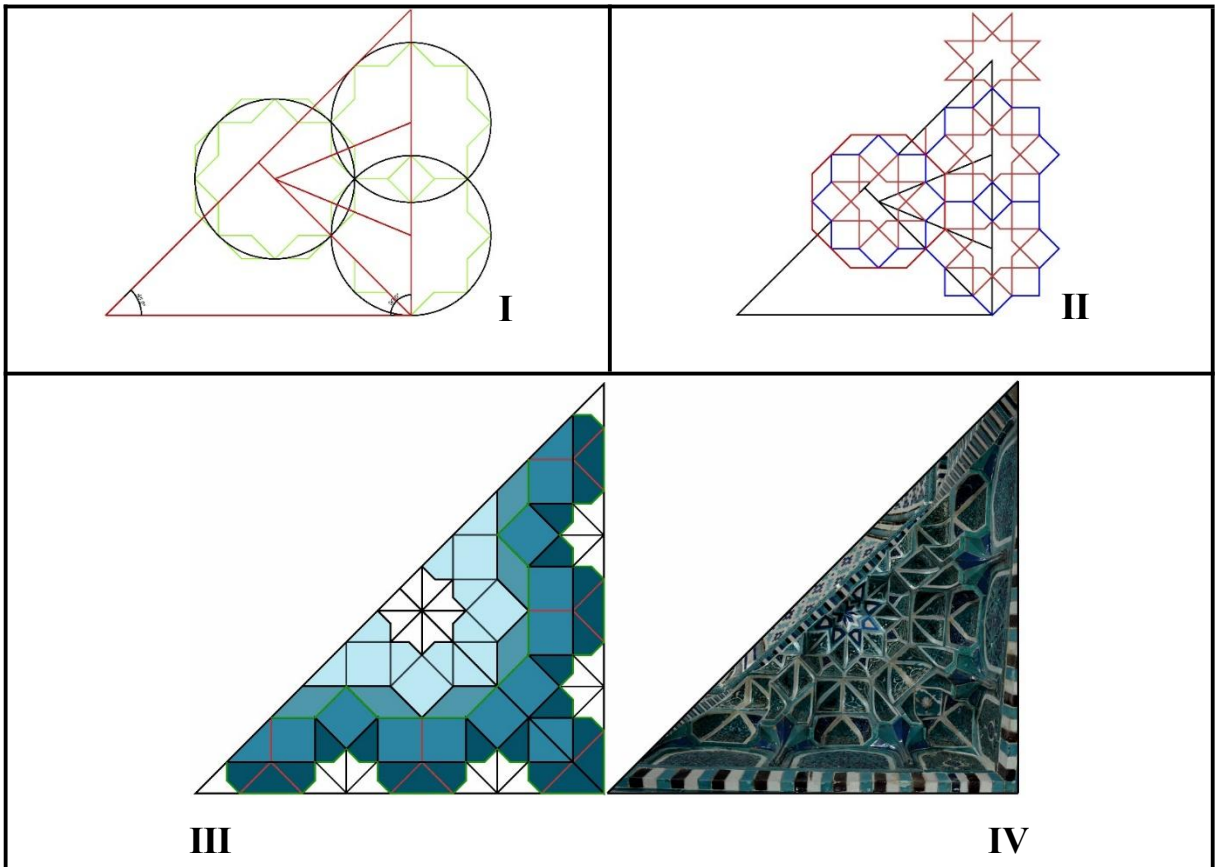
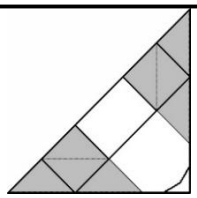
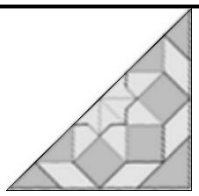
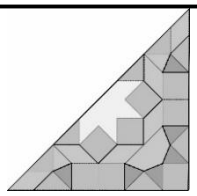
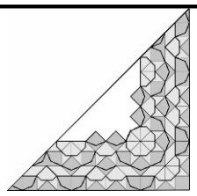
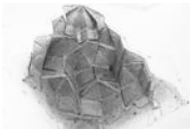
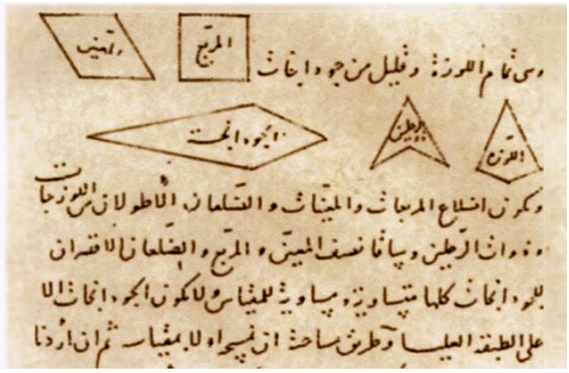
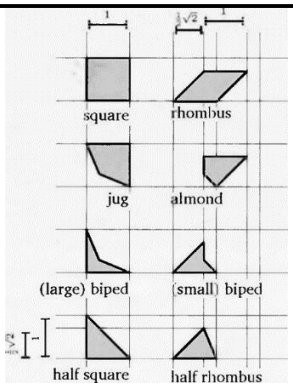


Fig 3. Construction of stalactites in mausoleum of Kusam-ibn-Abbas (1335). Corner Squinch. Geometric analysis and photo sourses by Sh. Mustafoev. 1. Beam grid (departing from the center of Shamseh - Nayzagi); 2. Geometric basis - "girih" figurative polygonal geometry; 3. Analysis - projection of series; 4. Typology of building blocks.

EVOLUTION OF STALACTITES IN CENTRAL ASIA IN IX-XIV CENTURIES. AN ANGULAR PART OF THE ARCHITECTURE – SQUINCH.			
XI th century.	*XII th century.*	*Beg. of the XIV th century*	*XIV th century.*

			
			
Mane Baba mausoleum.	*Arslan - II mausoleum. Kunyaurgench, Turkmenistan.*	*Mazlum sula khan mausoleum. Mizdakhan, Nukus.*	*Usto Ali Nesefi mausoleum. Shah-I-Zinda, Samarqand. Squinch.*

	
Constituent elements of muqarnas as introduced by Al-Kashi. Source by Dold-Samplonius, 1992.	*Basic muqarnas elements of Al-Kashi by Harmsen, 2006.*

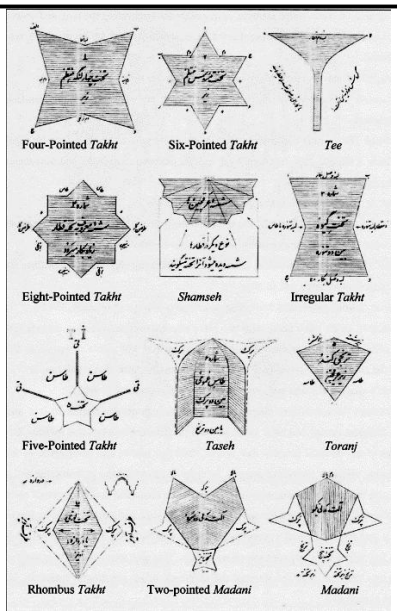
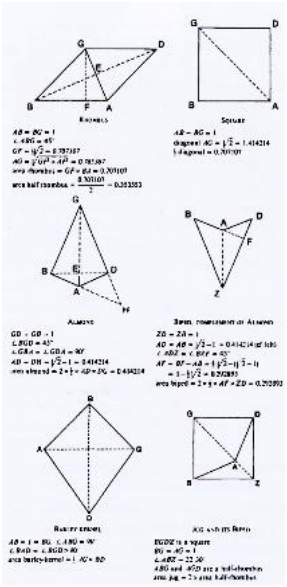
	
Constituent elements of muqarnas, from Usta Lorzadeh. Source: adapted by Hamidreza Kazempour from Lorzadeh, 1981.	*Geometrical definition of Al-Kashi's curved muqarnas components by Dold- Samplonius, 1992.*

Table 3. Constituent elements of muqarnas

REFERENCES

1 Andreev, M.S. (1956). Starinnie svitki albomi iz Buxari s obrazsami arxitekturnogo ornamenta (Architectural albums from Bukhara with samples of geometric ornamentation.). «Izv. Otd. obsh. nauk AN Tadj. SSR» (№.10 - II.). Stalinabad. pp. 121 – 136.

2. Dold-Samplonius, Y. (1992). Practical Arabic Mathematics: Measuring the muqamas by ALKashi. Centaurus, 35, pp. 193-242.

3. Мустафоев, Ш. Ш. (2022). VIII-XIII АСРЛАРДА ЎЗБЕКИСТОН МЕЬМОРИЙ БЕЗАКЛАРИДА ГИРИҲ ВА МУҚАРНАСЛАРНИНГ ШАКЛЛАНИШИ. *Oriental Art and Culture*, *3*(3), 268-278.

4. Mustafoev, S. (2021). Traditional Modularity System in Uzbek and Persian Mimars: Construction of Muqarnas. *Texas Journal of Multidisciplinary Studies*, *3*, 108-116.

5. Sh, M. S. (2021). CONSTRUCTION OF THE “GIRIH”-GEOMETRIC PATTERN. BASED ON “BUKHARA SCROLLS”. *Вестник науки*, *1*(10 (43)), 4-13.
6. Sh, M. (2019). GEOMETRIC ANALYSIS OF GEOMETRIC PATTERNS (GIRIH) ON “DAFTAR”. *Problems of Architecture and Construction*, *2*(3), 22-27.
7. Мустафоев, Ш. Ш. (2023). ТЭОРИЯ ПОСТРОЕНИЯ И СОСТАВЛЕНИЯ ГИРИХОВ–«ГИРИХСАЗИЙ». *Journal of new century innovations*, *21*(3), 41-55.
8. Mustafoev, S. HISTORICAL DEVELOPMENT AND CONSTITUENT ELEMENTS OF MUQARNAS IN THE ISLAMIC WORLD.
9. Mustafoev, S. DECODING GEOMETRIC PROPERTIES OF MUQARNAS BASED ON ARCHITECTURAL SCROLL. ACADEMICIA: An International Multidisciplinary Research Journal, 11(12), 618-628.
10. Yusupova, M. (1997). L’évolution architecturale des couvents soufis à l’époque timouride et post-timouride. *Cahiers d’Asie centrale*, (3/4), 229-250.
11. Юсупова, М. А. (2000). Традиции архитектурного сада “чарбаг” в зодчестве Бухары XVI–XVIII вв. In *Средняя Азия. Археология. История. Культура. Материалы международной конференции. М* (pp. 247-251).
12. Юсупова, М. А. (2000). Бухарская школа зодчества XV-XVII вв.(особенности и динамика развития).
13. Yusupova, M. A. (2004). Dva etuda po istorii arhitekturı Uzbekistana, svyazannıh s evreyskoy diasporı. *Evreyi Sredney Azii,(Taşkent: İzdatel’stvo Fan Akademii Nauk, 2004)*.
14. Yusupova, M. (2012). Islamic architecture of Uzbekistan: Development and features. *Journal of Islamic Thought and Civilization*, *2*(2), 51-63.
15. Раупова, А., & Юсупова, М. А. (2022). К Изучению Особенностей Архитектуры Караван-Сарая Коба Города Шахрисабза. *Central Asian Journal of Theoretical and Applied Science*, *3*(7), 178-185.
16. Yusupova, M. (1997). L’évolution architecturale des couvents soufis à l’époque timouride et post-timouride. *Cahiers d’Asie centrale*, (3/4), 229-250.

17. Юсупова, М. А. (2019). Особенности колониального градостроительства в" европейских городах" Ферганской долины (конец XIX в.-начало XX в.). *ВЕСТНИК ЕВРАЗИЙСКОГО НАЦИОНАЛЬНОГО УНИВЕРСИТЕТА ИМЕНИ ЛН ГУМИЛЕВА СЕРИЯ: ТЕХНИЧЕСКИЕ НАУКИ И ТЕХНОЛОГИИ*, (2).
18. Юсупова, М. А. (2013). К ВОПРОСУ РЕСТАВРАЦИИ ПАМЯТНИКОВ АРХИТЕКТУРЫ УЗБЕКИСТАНА В 1990-2010 ГГ. *Вестник Кыргызского государственного университета строительства, транспорта и архитектуры им. Н. Исанова*, (4), 170-174.
19. Isakov, V. Y., Mirzayev, U. B., & Yusupova, M. A. (2006). PROPERTIES AND FEATURES OF SAND SOILS ARRAYS OF THE FERGANA VALLEY. *O 'ZBEKISTON BIOLOGIYA JURNALI*, 49.
20. Юсупова, М. А. (1993). Градостроительство и архитектура новых городов Ферганской долины конца XIX-начала XX вв.
21. Yusupova, M. Cahiers d'Asie centrale.
22. Yusupoa, M. Complexes in Bukhara.
23. Yusupova, M. A. Characteristics of the colonial town planning in" european cities" of fergana valley (end of 19 th–beginning of 20 th centuries).
24. Ozodovich, H. A., & Maribovich, Q. I. (2022). Improving the Design of Youth Innovative-Creative and Development Scientific Centers. *Eurasian Scientific Herald*, *7*, 72-76.
25. Mahmudov, O. Z. O., & Kasimov, I. M. (2021). THE STUDY OF THE GEOECOLOGICAL PROBLEMS OF A BIG CITY. *Academic research in educational sciences*, *2*(4), 271-275.
26. Раззаков, С. Ж., Холбоев, З. Х., & Косимов, И. М. (2020). Определение динамических характеристик модели зданий, возведенных из малопрочных материалов.
27. Dedakhanov, B., & Kasimov, I. (2022). ANCIENT ARCHITECTURE OF THE FERGHANA VALLEY FEATURES OF FORMATION AND DEVELOPMENT (ON

THE EXAMPLE OF CIVIL ARCHITECTURE AND URBAN PLANNING). *Science and innovation*, *1*(C6), 278-284.

28. Арифжанов, А. М., Фатхуллаев, А. М., Самиев, Л. Н., & Косимов, И. (2015). Установившееся неравномерное движение взвесенесущего потока в верхнем бьефе гидроузла. *Актуальные проблемы гуманитарных и естественных наук*, (5-2), 204-207.
29. Дедеханов, Б., Қосимов, И. М., Адилов, З. Р., & Раҳимова, Г. Э. (2022). ФАРҒОНА ВОДИЙСИ ҚАДИМГИ АРХИТЕКТУРАСИНИ ШАКЛЛАНИШИ ВА РИВОЖИДА ҚУРИЛИШ МАТЕРИАЛЛАРИНИНГ РОЛИ. *Journal of new century innovations*, *19*(2), 176-185.
30. Адилов, З. Р., Қосимов, И. М., Дедеханов, Б., & Раҳимова, Г. Э. (2022). НАМАНГАН ВИЛОЯТИДАГИ ХЎЖА АМИН МАҚБАРАСИ. *Journal of new century innovations*, *19*(2), 152-160.
31. Қосимов, И. М., Дедеханов, Б., Адилов, З. Р., & Раҳимова, Г. Э. (2022). ЎЗБЕКИСТОНДА КАСБГА ЙЎНАЛТИРИШ МАРКАЗЛАРНИНГ ИННОВАТЦИОН АРХИТЕКТУРАСИНИ ШАКЛЛАНТИРИШ. *Journal of new century innovations*, *19*(2), 169-175.
32. Maribovich, Q. I. (2022). Scientific Proposals for Architectural Improvement of Engineering Centers. *Nexus: Journal of Advances Studies of Engineering Science*, *1*(6), 59-63.
33. Хасанов, А. Н., Аббасова, Р. К., & Маърибович, Қ. И. (2022). КАСБ ҲУНАР МАЖМУАЛАРИНИНГ ПАЙДО БЎЛИШ ТАРИХИ (ФАРҒОНА ВОДИЙСИ МИСОЛИДА). *Journal of new century innovations*, *19*(1), 198-204.
34. Rahimova, G., Dedaxanov, B., Adilov, Z., & Qosimov, I. (2022). USE OF INNOVATIVE METHODS IN DEVELOPING PROFESSIONAL SKILLS OF STUDENTS. *Journal of new century innovations*, *19*(2), 161-168.

35. Ozodovich, H. A., Maribovich, Q. I., & Zarina, B. (2023). KASBGA YO'NALTIRISH MARKAZINI INNOVATSION LOYIHASI TAKLIFI "KIDZANIA JOB WORLD IN TASHKENT". *PEDAGOG*, *1*(5), 120-129.
36. Рахимова, Г., Илхом, Қ., & Дедаханов, Б. (2023). ТАЪЛИМ ЖАРАЁНИДА ИННОВАЦИОН ТЕХНОЛОГИЯЛАРНИНГ ЎРНИ. *Journal of new century innovations*, *21*(3), 33-40.
37. Хасанов, А. О., & Қосимов, И. М. (2023). ЎЗБЕКИСТОН ШАРОИТИДА КАСБГА ЙЎНАЛТИРИШ МАРКАЗЛАРИНИ АРХИТЕКТУРА ТАКЛИФИ. *Journal of new century innovations*, *21*(1), 144-150.
38. Хасанов, А. О., & Қосимов, И. М. (2023). ЖАМИЯТНИ РИВОЖЛАНТИРИШДА КАСБГА ЙЎНАЛТИШ МАРКАЗЛАРНИ ЛОЙИҲАЛАШНИ ОПТИМАЛЛАШТИРИШ. *Journal of new century innovations*, *21*(1), 136-143.
39. Zokirjon o'g'li M. O., Kasimov I. M. MODELING OF BUILDINGS //Web of Scientist: International Scientific Research Journal. – 2021. – Т. 2. – №. 05. – С. 772-781.
40. Ravshanovich, A. Z. (2021). Issues Of Improving Tourism Opportunities In Namangan Region. *International Journal of Progressive Sciences and Technologies*, *26*(2), 40-44.
41. Adilov, Z. (2021, June). ISSUES OF IMPROVING TOURIST OPPORTUNITIES IN NAMANGAN REGION. In *Конференции*.
42. Адилов, З. Р., & Болгабоев, Д. (2021). РЕСТАВРАЦИЯ И СОХРАНЕНИЕ СУЩЕСТВУЮЩИХ ИСТОРИЧЕСКО-АРХИТЕКТУРНЫХ ПАМЯТНИКОВ НАМАНГАНСКОЙ ОБЛАСТИ-ОСНОВА РАЗВИТИЯ МЕЖДУНАРОДНОГО ТУРИЗМА. *Вестник Науки и Творчества*, (11 (71)), 38-44.
43. Ravshanovich, A. Z. (2021). Namangan Historical Architectural Monuments. *Design Engineering*, 6940-6945.
44. Адилов, З. Р., & Рахмонбердиев, С. (2021). НАМАНГАН ВИЛОЯТИНИНГ ТУРИЗМ ИМКОНИЯТЛАРИНИ ТАКОМИЛЛАШТИРИШ МАСАЛАЛАРИ. *Вестник Науки и Творчества*, (11 (71)), 34-37.

45. Адилов, З. Р. (2021). ЗАЩИТА КУЛЬТУРНОГО НАСЛЕДИЯ СОКРОВИЩА НАШЕГО НАРОДА-ОСНОВА НАШИХ НАЦИОНАЛЬНЫХ ЦЕННОСТЕЙ. In *НАУКА И ПРОСВЕЩЕНИЕ: АКТУАЛЬНЫЕ ВОПРОСЫ, ДОСТИЖЕНИЯ И ИННОВАЦИИ* (pp. 249-252).
46. Адилов, З. Р. (2022). ЁШЛАРГА МАДАНИЙ МЕРОС ҲАЗИНАСИНИ ТАРҒИБ ҚИЛИШ МАСАЛАЛАРИ. *ИЖТИМОИЙ ФАНЛАРДА ИННОВАЦИЯ ОНЛАЙН ИЛМИЙ ЖУРНАЛИ*, *2*(4), 124-130.
47. Adilov, Z. R. (2022). Peculiarities of Construction Drawings. *EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION*, *2*(4), 227-230.
48. Адилов, З. Р. (2022). НАМАНГАН ВИЛОЯТИ МАДАНИЙ МЕРОС ҲАЗИНАСИНИ АСРАШ МИЛЛИЙ ҚАДРИЯТЛАРИМИЗНИНГ АСОСИДИР. *TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI*, 69-73.
49. Адилов, З. Р. (2022). URBAN PLANNING OF THE CITIES OF NAMANGAN REGION. *Science and Innovation*, *1*(6), 259-264.
50. Adilov, Z. (2021, August). ISSUES OF IMPROVING TOURIST OPPORTUNITIES IN NAMANGAN REGION: https://doi. org/10.47100/conferences. v1i1. 1224. In *RESEARCH SUPPORT CENTER CONFERENCES* (No. 18.05).
51. Adilov, Z. (2022). НАМАНГАН ВИЛОЯТИ ШАҲАРЛАРИНИНГ ШАҲАРСОЗЛИГИ. Science and innovation, 1(C6), 259-264.
52. Khasanov, A. (2020). Organizing Eco Tourism Along With Uzbek National Automagistrale Way. *Solid State Technology*, *63*(6), 12674-12678.
53. Ozodovich, X. A., & Azim o'g'li, N. A. (2021). Formation of the “Obod Mahalla” System in the Villages of Uzbekistan and Serving the Population. *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI*, *1*(5), 325-329.
54. Khasanov, A. (2016). About several infrastructure constructions of the Great Silk Road. *Int’l J Innov Sci Eng Technol*, *3*(6), 295-299.
55. Inogamov, B. I., & Khasanov, A. O. (2021). Taking Into Account Socio-Functional Factors in the Design of Housing. *Design Engineering*, 2587-2589.

56. Matjanov, O. K., Xasanov, A. A., & Boltabayev, P. L. Y. (2022, August). ILMIY TADQIQOT VA INNOVATSION MARKAZLARNI LOYIHALASH VA QURISHNING BUGUNGI KUNDAGI AHAMIYATLI TALABLARI VA QONUNIYATLARINI SHAKLLLANTIRISH. In *INTERNATIONAL CONFERENCES* (Vol. 1, No. 7, pp. 36-39).

57. Matjanov, O. K., Xasanov, A. A., & Boltabayev, P. L. Y. (2022). ILMIY TADQIQOT VA INNOVATSION MARKAZLAR ARXITEKTURASINING SHAKLLANISHI VA RIVOJLANISH AN'ANALARI. *Oriental renaissance: Innovative, educational, natural and social sciences*, *2*(5-2), 214-217.

58. Xasanov, A. A., Ro'Zmetov, Q. S., Duschanov, S. S., & Duschanov, R. D. O. G. L. (2022). YUSUF HAMADONIY ZIYORATGOHIDA ZIYORAT VA DAVOLANUVCHILAR UCHUN KICHIK EKOTURISTIK MEHMONXONALARNING ORNI. *Oriental renaissance: Innovative, educational, natural and social sciences*, *2*(5-2), 674-679.

59. Khasanov, A. CONTEMPORARY DESTINATIONS SERVICE AND CREATING A SYSTEM OF HISTORICAL CARAVAN ROUTES.

60. Rahimova, G., Dedaxanov, B., Adilov, Z., & Qosimov, I. (2022). USE OF INNOVATIVE METHODS IN DEVELOPING PROFESSIONAL SKILLS OF STUDENTS. *Journal of new century innovations*, *19*(2), 161-168.