MODELS AND ALGORITHMS OF FRACTAL STRUCTURED PATTERNS VISUALIZATION.

Mamirov Diyorbek
TUIT (501-21 group master)
mamiroffdiyor@gmail.com

Abstract. In order to solve the problem in the application and optimization method of fractal art pattern generation, on the basis of the integration of the fractal theory and genetic algorithm, a generation method based on genetic algorithm and composition generation was proposed. The method provided a more stable and convenient supporting environment for the innovative design of artistic patterns, which met the needs of different users for the design of artistic patterns. The experimental results showed that the simplified genetic programming algorithm was optimized in both individual coding complexity and algorithm complexity. The search space was 1023-1026 times larger than the traditional algorithm, and the evaluation times were 2-3 times larger than the traditional algorithm. The results showed that the method could solve the problem that fitness function could not express well and ensure the optimal genetic population.

Annotatsiya. Fraktal san'at namunalarini yaratishni qo'llash va optimallashtirish usulidagi muammoni hal qilish uchun fraktal nazariya va genetik algoritmni integratsiyalashuvi asosida genetik algoritm va kompozitsiyani yaratishga asoslangan avlod usuli taklif qilindi. Usul badiiy naqshlarning innovatsion dizayni uchun yanada barqaror va qulay qo'llab-quvvatlovchi muhitni ta'minladi, bu turli foydalanuvchilarning badiiy naqshlarni loyihalash uchun ehtiyojlarini qondirdi. Eksperimental natijalar shuni ko'rsatdiki, soddalashtirilgan genetik dasturlash algoritmi individual kodlash murakkabligida ham, algoritm murakkabligida ham optimallashtirilgan. Qidiruv maydoni an'anaviy algoritmdan 1023-1026 marta, baholash vaqtlari esa an'anaviy algoritmdan 2-3 baravar ko'p edi. Natijalar shuni ko'rsatdiki, bu usul fitnes funktsiyasi yaxshi ifoda eta olmaydigan muammoni hal qilishi va optimal genetik populyatsiyani ta'minlashi mumkin.

Аннотация. Для решения проблемы применения и оптимизации метода генерации фрактального художественного паттерна на основе интеграции теории фракталов и генетического алгоритма был предложен метод генерации, основанный на генетическом алгоритме и генерации композиции. Метод обеспечил более стабильную и удобную вспомогательную среду для инновационного дизайна художественных узоров, которая удовлетворяла потребности разных пользователей в дизайне художественных узоров. Экспериментальные результаты показали, что упрощенный алгоритм генетического программирования был оптимизирован как по индивидуальной сложности кодирования, так и по сложности алгоритма. Пространство поиска было в 1023-1026 раз больше, чем у традиционного алгоритма, а время вычисления было в 2-3 раза больше, чем у традиционного алгоритма. Результаты показали, что этот метод может решить проблему,

связанную с тем, что функция приспособленности не может быть хорошо выражена, и обеспечить оптимальную генетическую популяцию.

Keywords: Pattern, Fitness function, Innovative design, Fractal theory.

Kalit so'zlar: Naqsh, Fitness funktsiyasi, Innovatsion dizayn, Fraktal nazariya.

Ключевые слова: Узор, Фитнес-функция, Инновационный дизайн, Теория фракталов.

Introduction. Computer-aided pattern modeling can be described as an artistic activity that uses computers to make artistic compositions. The traditional artistic pattern adopts the Euclidean geometric method, through the application of aesthetic principles and composition rules, the pattern composed of basic geometric elements (points, lines, surfaces) is repeated in a systematic manner, and the cross combination, arrangement, layout and color of transformation or position changes, resulting in a variety of modeling patterns. Due to the tremendous development of computer technology, the traditional method of artistic composition has undergone fundamental changes. The use of trackballs, touch screens, and digitizers provides a variety of input methods for computer humancomputer interaction. The emergence of raster graphics displays makes computer graphics more realistic, and the effects that were difficult to achieve or impossible to achieve have become possible due to the emergence of computers. With the improving of the people's living standard, huge changes have taken place in modern people's consumption idea. More and more attention is paid to the commodity external beauty and modelling embodies artistry when buying a commodity. Some companies are beginning to realize the change of people consumption idea and pay more attention to art and design innovation in the process of production . The artistic design innovation of products is more embodied in the design field of art patterns. The combination of fractal theory and computer graphics design technology can generate more beautiful and complex fractal art patterns with the help of relatively simple iterative formula, which is also more suitable for the aided design of art patterns. For enterprises, they should consider how to use a simple communication interface platform that allows designers who otherwise have little knowledge of fractal theory to modify it with a small number of parameters . Art pattern can satisfy the consumers' demand, which is generated by using fractal theory of art design. The designers need to consider the problem at the present stage, which is also the focus of the research.

Fractal design software and calculation principle. There are dozens of software for fractal pattern modeling design and generation, among which the most popular and widely used software are Apophysis and Ultra Fractal. Since these characteristics of Apophysis software are in line with the research and discussion in this paper and the problems to be solved, this topic chooses to use this software system in the application research part. Apophysis is developed based on the theory of iterative function system (IFS) generation method. The main features of the software are: the software has many built-in function plug-ins, and there are

also many function plug-in resources on the Internet. These function plug-ins can be used to achieve Countless wonderful graphic transformations make the pattern produce dazzling and shocking light and shadow effects. While infinitely possible artistic patterns can be designed, the requirements for designers in mathematics are not high . The complex dynamical system is a nonlinear iterative function.

$$Z_{N+1} = F(Z_N) \qquad (1)$$

Iterate the initial value Z0 to obtain trajectory points such as Z1 and Z2, and represent these points on the complex plane. Its chaotic set is a fixed set that tends to zero in each iteration and an escape set that tends to ∞ in each iteration. separate. In order to generate colorful patterns, the escape set of the external structure can be filled with different colors according to the speed of escape speed; the periodic orbit of the internal structure can be recorded with an array, and different periods can be used with different colors, so as to draw a beautiful M set and J set.

Fractal composition is the design of the combination form and structure of pattern modeling. Excellent composition skills can fully reflect the creativity of artistic design. In the existing fractal pattern modeling design, there are two main methods of pattern combination: one is to synthesize the fractal pattern by traditional skeleton positioning; the other is based on computer-aided combination technology. This paper proposes three combined methods on the technology of these two methods.

To create a fractal pattern, the fractal image should be drawn by computer first, and its fineness can be set by parameters, and the fractal calculation result is saved for compound editing. The plane processing of fractal graphics can use the software photoshop to adjust the color and the transparency of the layer. But the plane software can't get the real and changeable space effect. To this end, you can consider the use of 3D and rendering software such as 3ds max to obtain the effect of spatial transformation. For example: 3ds max has a variety of texture coordinate functions, free lighting effects and arbitrary camera view angles, which can be used for special effects processing of patterns.

Conclusions. In the age of Internet of Things, fractal geometry is an emerging subject, it is linked with computer graphics to create peculiar and changeable patterns, and these patterns are formed by a series of affine transformations using geometric formulas, and are designed with computergenerated fractal graphics. Pattern is a novel pattern-aided design method. In this paper, this method is discussed in a certain range, and a useful attempt is made, and a novel spherical mirror reflection technology is proposed, which has achieved satisfactory results. The use of computer aids in the design of fractal graphics makes the design of fractal patterns enter a new level. This paper studies the methods and principles of fractal pattern design, and innovatively proposes to combine fractal pattern design with image processing software, especially with 3D modeling and rendering software, to obtain a convenient method for obtaining spatial transformation

effects. Fractal pattern design approach. The whole process here is realized on the computer. This new design idea and method with the development of computer application technology, which combines mathematics, computer application and art, has considerable practical significance.

References

1. Tian, G.; Yuan, Q.; Hu, T.; et al.: Auto-generation system based on fractal geometry for batik pattern design, Applied Sciences, 9(11), 2019, 2383-2403.
2. Çimen, M.-E.; GARİP, Z.; Boyraz, Ö.-F.; et al.: An interface design for calculation of fractal dimension, Chaos Theory and Applications, 2(1), 2020, 3-9.
3. Mostafa, M.-E.; Nafady, D.-A.: Fractals between theory and practice and its use in enriching the field of design, International Design Journal, 11(3), 2021, 31-41
4. Urinov, K. O., Jumanov, K. A., Khidirov, A. M., Urinov, S. K., Abdiyev, J. M., Jumaboyev, T. A., & Eshmirzayev, M. R. (2020, April). Magnetocaloric effect in polycrystalline cobalt. In *Journal of Physics: Conference Series* (Vol. 1515, No. 2, p. 022079). IOP Publishing.
5. Saidov, A. S., Saparov, D. V., Usmonov, S. N., Kutlimratov, A., Abdiev, J. M., Kalanov, M., ... & Akhmedov, A. M. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si2) 1-x (GaP) x Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111). *Advances in Condensed Matter Physics*, *2021*.
6. LEYDERMAN, A., Saidov, A. S., USMONOV, S., Abdiyev, J. M., & Suyarov, Q. T. (2021, February). INFLUENCE OF WEAK GRADED GAP ON INJECTION DIFFUSION REGIMES OF CURRENT TRANSPORT IN SEMICONDUCTOR PN-STRUCTURES. In *Congress Dates* (p. 40).
7. Raufovich, M. R., & Muzaffar o'g'li, A. J. (2022). THE ROLE OF TEACHER AND STUDENT COOPERATION IN THE MODERN EDUCATIONAL PROCESS OF GOOGLE DOCS. *Web of Scientist: International Scientific Research Journal*, *3*(1), 579-589.
8. Abdiev, J., Safarov, O., & Julanov, H. (2022). Study of the properties of polymer composites–reinforcement based on glass and basalt fibers. *Eurasian Scientific Herald*, *7*, 77-88.
9. Urinov, K. O., Jumanov, K. A., Khidirov, A. M., Urinov, S. K., Abdiyev, J. M., Jumaboyev, T. A., & Eshmirzayev, M. R. (2020). Magnetocaloric effect in polycrystalline cobalt. In *Journal of Physics: Conference Series* (Vol. 1515, p. 022079).
10. Urinov, K. O., Jumanov, K. A., Khidirov, A. M., Urinov, S. K., Abdiyev, J. M., Jumaboyev, T. A., & Eshmirzayev, M. R. (2020). Magnetocaloric effect in polycrystalline cobalt. In *JOP Conference Series: Metrological Support of Innovative Technologies* (pp. 22079-22079).

11. Urinov, K. O., Jumanov, K. A., Khidirov, A. M., Urinov, S. K., Abdiyev, J. M., Jumaboyev, T. A., & Eshmirzayev, M. R. (2020, April). Magnetocaloric effect in polycrystalline cobalt. In *Journal of Physics: Conference Series* (Vol. 1515, No. 2). IOP Publishing.
12. Urinov, K. O., Jumanov, K. A., Khidirov, A. M., Urinov, S. K., Abdiyev, J. M., Jumaboyev, T. A., & Eshmirzayev, M. R. (2020, April). Magnetocaloric effect in polycrystalline cobalt. In *Journal of Physics Conference Series* (Vol. 1515, No. 2, p. 022079).
13. Saidov, A. S., Saparov, D. V., Usmonov, S. N., Kutlimratov, A., Abdiev, J. M., Kalanov, M., ... & Akhmedov, A. M. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si2) 1-x (GaP) x Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111). *Advances in Condensed Matter Physics*, *2021*.
14. Bolkievna, I. A. LEARNING FROM UZBEK AND PERSIAN TRADITIONS: THE ROLE OF ENVIRONMENTAL PERCEPTIONS IN THE CREATION OF SPACE IS A GARDEN-CREATING PARADISE.
15. Saidov, A. S., Saparov, D. V., Usmonov, S., Kutlimratov, A., Abdiev, J. M., Kalanov, M., ... & Akhmedov, A. M. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si 2) 1-x (GaP) x 0≤ x≤ 1 Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111). *Advances in Condensed Matter Physics*, *2021*.
16. Saidov, A. S., Saparov, D. V., Usmonov, S. N., Kutlimratov, A., Abdiev, J. M., Kalanov, M., ... & Akhmedov, A. M. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si2)(GaP) x (0≤ x≤ 1) Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111).
17. Saidov, A. S., Saparov, D. V., Usmonov, S. N., Kutlimratov, A., Abdiev, J. M., Kalanov, M., & Razzakov, A. S. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si [sub. 2])[sub. 1-x](GaP)[sub. x](0≤ x≤ 1) Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111). *Advances in Condensed Matter Physics*, *2021*.
18. Saidov, A. S., Saparov, D. V., Usmonov, S. N., Kutlimratov, A., Abdiev, J. M., Kalanov, M., ... & Akhmedov, A. M. (2021). Investigation of the Crystallographic Perfection and Photoluminescence Spectrum of the Epitaxial Films of (Si 2) 1-x (GaP) x 0≤ x≤ 1 Solid Solution, Grown on Si and GaP Substrates with the Crystallographic Orientation (111). *Advances in Condensed Matter Physics*.
19. LEYDERMAN, A. Y., SAIDOV, A., USMONOV, S. N., ABDIYEV, J., & SUYAROV, Q. (2021, February). INFLUENCE OF WEAK GRADED GAP

ON INJECTION DIFFUSION REGIMES OF CURRENT TRANSPORT IN SEMICONDUCTOR PN-STRUCTURES. In *Congress Dates* (p. 40).

20. LEYDERMAN, A. Y., SAIDOV, A., USMONOV, S. N., ABDIYEV, J., & SUYAROV, Q. (2021, February). INFLUENCE OF WEAK GRADED GAP ON INJECTION DIFFUSION REGIMES OF CURRENT TRANSPORT IN SEMICONDUCTOR PN-STRUCTURES. In *Congress Dates* (p. 40).
21. Leiderman, A. Y., Saidov, A. S., & Abdiyev, J. M. (2021). INJECTION DIFFUSION PROCESSES IN THE WEAK LINEAR GRADED-BAND SEMICONDUCTOR pn-STRUCTURES. *Euroasian Journal of Semiconductors Science and Engineering*, *3*(1), 3.
22. Leiderman, A. Y., Saidov, A. S., & Abdiyev, J. M. INJECTION DIFFUSION PROCESSES IN THE WEAK LINEAR GRADED-BAND SEMICONDUCTOR pn-STRUCTURES. *Journal of Semiconductors*, *3*(1), 3.
23. Abdiev, J., Safarov, O., & Julanov, H. (2022). Study of the properties of polymer composites–reinforcement based on glass and basalt fibers. *Eurasian Scientific Herald*, *7*, 77-88.
24. Abdiev, J., Safarov, O., & Julanov, H. Study of the properties of polymer composites–reinforcement based on glass and basalt fibers.
25. Abdiev, J., & Safarov, O. (2022). BASALT FIBER-BASIC (PRIMARY) CONCEPTS. *Web of Scientist: International Scientific Research Journal*, *3*(4), 212-240.
26. Abdiev, J., & Safarov, O. BASALT FIBER-BASIC (PRIMARY) CONCEPTS.
27. KUŞÇULU, N. (2021). Congress Dates.
28. Abdiev, J., Safarov, O., & Julanov, H. (2022). Study of the properties of polymer composites–reinforcement based on glass and basalt fibers. *Eurasian Scientific Herald*, *7*, 77-88.
29. Abdiev, J., Safarov, O., & Julanov, H. (2022). Study of the properties of polymer composites–reinforcement based on glass and basalt fibers. *Eurasian Scientific Herald*, *7*, 77-88.
30. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
31. Abdiev, J., Safarov, O., & Julanov, H. Study of the properties of polymer composites–reinforcement based on glass and basalt fibers.
32. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
33. Bolkievna, I. A., & AbdievMuzaffar o'g'li, J. (2022). LEARNING FROM UZBEK AND PERSIAN TRADITIONS: THE ROLE OF ENVIRONMENTAL PERCEPTIONS IN THE CREATION OF SPACE IS A GARDEN-CREATING PARADISE. *Web of Scientist: International Scientific Research Journal*, *3*(4), 188-211.

34. Bolkievna, I. A. LEARNING FROM UZBEK AND PERSIAN TRADITIONS: THE ROLE OF ENVIRONMENTAL PERCEPTIONS IN THE CREATION OF SPACE IS A GARDEN-CREATING PARADISE.
35. KUŞÇULU, N. (2021). Congress Dates.
36. Abdiev, J., & Safarov, O. BASALT FIBER-BASIC (PRIMARY) CONCEPTS.
37. KUŞÇULU, N. (2021). Congress Dates.
38. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
39. KUŞÇULU, A. P. D. N. Access Date: 22.06. 2021.
40. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
41. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
42. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
43. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
44. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
45. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
46. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
47. Taylanov, N. A. (2022). A Fourth-Order Runge-Kutta Method for Numerical Solution of the Kuramoto-Sivashinsky Equation. *Eurasian Scientific Herald*, *7*, 58-61.

48. Taylanov, N. A. (2022). A Fourth-Order Runge-Kutta Method for Numerical Solution of the Kuramoto-Sivashinsky Equation. *Eurasian Scientific Herald*, *7*, 58-61.
49. Abdurazzokovich, N., Xudoyor o'g'li, S., & Muzaffar o'g'li, J. A Fourth-Order Runge-Kutta Method for Numerical Solution of the Kuramoto-Sivashinsky Equation.
50. Abdiev, J., Abdieva, N. M., & Khasanova, D. Y. (2022). Physical Terms, Problems and Their Solutions. *Problems and Their Solutions (March 25, 2022)*.
51. Ortikovich, U. J., Muzaffar o'g'li, A. J., & Rafikovich, M. R. **Fex V**3− x **O4**MAGNETIC AND ELECTRICAL PROPERTIES OF SPINEL.
52. Ortikovich, U. J., Muzaffar o'g'li, A. J., & Rafikovich, M. R. **Fex V**3− x **O4**MAGNETIC AND ELECTRICAL PROPERTIES OF SPINEL.
53. KUŞÇULU, N. (2021). Congress Dates.
54. KUŞÇULU, N. (2021). Congress Dates.
55. KUŞÇULU, N. (2021). Congress Dates.
56. Safarov, O. (2022). UNDERSTANDING THE MAGNETO CALORIC EFFECT IN SUPER SPIN GLASS COBALT-BASED NANOPARTICLES. *Web of Scientist: International Scientific Research Journal*, *3*(7), 545-563.
57. Qo'Chqarovna, M. U., & Safarali, D. (2022). Theory of dependence of ultrasound absorption (amplification) in semiconductors on electron scattering mechanism. *Web of Scientist: International Scientific Research Journal*, *3*(7), 480-489.
58. Qo'chqarovna, J. H., & Safarov, O. UNDERSTANDING THE MAGNETO CALORIC EFFECT IN SUPER SPIN GLASS COBALT-BASED NANOPARTICLES.
59. Qo'Chqarovna, M. U., Safarali, D., & Ugli, A. J. M. (2022). Theory of dependence of ultrasound absorption (amplification) in semiconductors on electron scattering mechanism.
60. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
61. Qo'chqarovna, M. U., & Safarali, D. THEORY OF DEPENDENCE OF ULTRASOUND ABSORPTION (AMPLIFICATION) IN SEMICONDUCTORS ON ELECTRON SCATTERING MECHANISM.
62. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
63. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF

ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).

64. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
65. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
66. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
67. Saidov, A. S., Usmonov, S. N., Karshiev, A. B., & Abdiev, J. M. (2022, December). Influence of the varizonal Si1-xGex solid solution composition on the thermovoltaic effect in n–Si–p–Si (1-x) Gex structure. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1112, No. 1, p. 012040). IOP Publishing.
68. Saidov, A. S., Usmonov, S. N., Karshiev, A. B., & Abdiev, J. M. (2022, December). Influence of the varizonal Si 1-x Ge x solid solution composition on the thermovoltaic effect in n-Si-p-Si (1-x) Ge x structure. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1112, No. 1, p. 012040).
69. Mavzuna, K., & Dilobar, A. (2022). MODELING TEXT RECOGNITION IN IMAGES. *Web of Scientist: International Scientific Research Journal*, *3*(10), 1280-1294.
70. Mavzuna, K. (2022). MODELING OF TEXT RECOGNITION IN IMAGES. *Spectrum Journal of Innovation, Reforms and Development*, *8*, 257-267.
71. Mavzuna, K. (2022). MODELING OF TEXT RECOGNITION IN IMAGES. *Spectrum Journal of Innovation, Reforms and Development*, *8*, 257-267.
72. Abdullayeva, D., Malikov, R., Amirkulov, S., & Yaxshimurodov, A. (2022, October). MATHEMATICAL MODELS IN THE EVALUATION OF HEALTH PROGRAMMES. In *Archive of Conferences* (pp. 129-152).
73. Abdullayeva, D., Malikov, R., Amirkulov, S., & Yaxshimurodov, A. (2022, October). MATHEMATICAL MODELS IN THE EVALUATION OF HEALTH PROGRAMMES. In *Archive of Conferences* (pp. 129-152).
74. Abdullayeva, D., Malikov, R., Amirqulov, S., & Yaxshimurodov, A. (2022, October). MATHEMATICAL MODELING SYSTEM MATLAB. In *E Conference Zone* (pp. 1-16).
75. Abdullayeva, D., Malikov, R., Amirqulov, S., & Yaxshimurodov, A. (2022, October). MATHEMATICAL MODELING SYSTEM MATLAB. In *E Conference Zone* (pp. 1-16).

76. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
77. al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM.
78. Xusanbek Ulug'bek o'g, M., al-Khwarizmi, M., Abdullayeva, D. O. T., qizi Abdieva, N. M., & Khasanova, D. Y. (2022, June). DEVELOPMENT OF ALGORITHMS AND PROGRAMS FOR PROCESSING SPEECH SIGNALS ON VISUAL DSP++ PLATFORM. In *E Conference Zone* (pp. 83-99).
79. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
80. Abdullayeva, D. O. T., Ismoilov, M. M., qizi Abdieva, N. M., & Khasanova, D. Y. (2022). Peach signal control software is an important part of our lives. *Eurasian Scientific Herald*, *7*, 145-152.
81. Abdullayeva, D. (2021). Independent Education in Higher Education. *INTERNATIONAL CONFERENCE ON MULTIDISCIPLINARY RESEARCH AND INNOVATIVE TECHNOLOGIES*, *2*, 217–220. Retrieved from http://mrit.academiascience.org/index.php/mrit/article/view/129