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Genetic Evolutionary Algorithm in Architecture: Analyzing the Methods of Genetic Evolutionary Algorithms in the Process of Reproducing the Aesthetic Values of Architectural Design

* Seyed Ali Yar Ebrahimi Vafai ** Mehdi Khakzand
*** Mohammad Hassan Talebian **** Mohammad Behzadpour
***** Fahimeh Motazedian
* Ph.D. student, Department of Architecture, Pardis Branch, Islamic Azad University, Tehran, Iran. aliyar.ebrahimi@ iau.ac.ir
** Associate Professor, Department of Architecture, Faculty of Architecture and Environmental Design, University of Science and Technology, Tehran, Iran. khakzand@ut.ac.ir
*** Full Professor, Department of Architecture, Faculty of Fine Arts, University of Tehran, Tehran, Iran. mh.talebian@ut.ac.ir
**** Assistant Professor, Department of Architecture, Hashtgerd Branch, Islamic Azad University, Hashtgerd, Iran. azabihi95@yahoo.com
***** Assistant Professor, Department of Architecture, Pardis Branch, Islamic Azad University, Tehran, Iran. motazedian@iau.ac.ir

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Abstract

This study aims to analyze the methods of genetic evolutionary algorithms in reproducing the aesthetic values of architectural design. The research problem arises from the fact that, despite the rapid advancement of computational technologies, the application of genetic algorithms in architecture has primarily focused on structural and functional optimization, with less attention given to the regeneration of aesthetic criteria such as balance, proportion, rhythm, harmony, and innovation. The novelty of this research lies in integrating aesthetic parameters with genetic mechanisms of selection, mutation, and crossover to create creative, harmonious, and efficient forms. The importance and necessity of the study stem from the need in contemporary architecture for intelligent, flexible, and multi-objective design tools, as well as the preservation and reinterpretation of cultural and artistic values within a digital framework.

The research employs an analytical approach based on qualitative content analysis. Data were collected from reputable international sources and coded according to seven main themes: fractal dimensions, neural networks, interactive structural design frameworks, conversational form generation, historical geometry concepts, implicit redundancy representation, and architectural shape optimization. The main hypothesis states that genetic algorithms can optimize and facilitate the process of reproducing aesthetic values in architecture, provided that chromosome structures, fitness criteria, and functional relationships are properly defined.

The findings indicate that the use of genetic algorithms in generative design enables the exploration of thousands of options, reduction of errors, enhancement of contextual integration, and improvement of project performance. This approach, while aligning with the results of

Corresponding Author: Mehdi Khakzand- Khakzand@ut.ac.ir

previous studies, offers a more comprehensive framework that can be applied in architectural education, design software development, heritage revitalization projects, and sustainable design. It is recommended that future research incorporate deep learning, virtual reality, and multi-dimensional performance indicators to further enhance the accuracy and efficiency of this process.

Keywords: Architectural Design, Genetic Algorithm, Evolutionary Algorithm, Aesthetic.