DOI: 10.34031/2071-7318-2024-10-3-68-81

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FLORISM: FUSING BIOMIMETIC ARCHITECTURE WITH DIVERSE FLOWER STRUCTURES

***Abstract.** Biomimetics in architecture specifically inspired by the structural features of various natural entities from the biosphere helps create a methodological framework for adopting and converting biological strategies into design innovations. Accordingly, the paper introduces under the newly coined term "florism" a novel concept that addresses a sustainability-oriented design principle evolved in the spirit of incorporating various parts of flowers in architectural designs with an aesthetic and constructional perception of their structural and functional qualities. In this concern, examples are drawn from several of the existing architectural designs inspired by the forms and functions of flowers, in justifying the application solutions that can be worked out to ensure the functionality and sustainability of buildings designed under florism. Further, the paper concentrates on innovations in the construction industry under florism that can enhance the aesthetic and functional efficiency of architectural designs in general.*

***Keywords:** florism, biomimetic architecture, sustainable design, energy effective, biomimetic principles, architecture and flowers*

Introduction. In many cities in the world, urban development has evolved into a process of nurturing concrete jungles with rigid monotonous-looking forms which appear to be eyesores [1]. The constructions that have emerged in this context pose detrimental effects on the existing thermal balance which directly impact the average air temperature of the urban areas and have long-lasting negative effects [1]. In this concern, biomimetics, an approach that draws inspiration from time-honoured natural designs, provides a promising framework for sustainable architectural practices adopting innovative constructional solutions that harmonize with nature, prevent challenges of environmental deterioration, and resolve the need for sustainable development [2, 3]. Taking a step further, the author endeavours in the paper to promote the adoption of the structural features of flowers in designing buildings to prevent monotony in urban environments. Accordingly, the author introduces the new term *florism*, coined from the combination of “flora” (flower) and “ism” (a distinctive doctrine, cause, or theory) in Latin (Mariam-Webster) to “define a rationale for the integration of biomimetic principles into architectural designs inspired by the elegance, efficiency, and sustainability of various structural features of flowers carefully studied under floral morphology” (Weber et al, 2019). The pursuit of sustainable architecture has led to the exploration of biomimetic design principles, drawing inspiration from the amazing efficiency and sustainability of nature [2, 4, 5]. In this context, "*florism*" represents the integration of biomimetic principles into architectural buildings specifically inspired by the structural appearance and organ functionality of flowers. By combining sustainable practices and floral aesthetics, *florism* aims to create environmentally conscious and visually appealing structures. Using the structural principles observed in flowers, architects can discover innovative strategies for designing buildings that optimize their energy use, enhance their durability, promote their natural ventilation, and improve their overall environmental performance.

Object of Scientific Research. The object of this research is to explore avenues of incorporating biomimetic architectural principles inspired by floral morphology, specifically under the concept of *florism*, in architectural constructions to advance sustainable urban design. By studying and interpreting the structural and functional attributes of flowers, this research aims to define new paradigms in architectural aesthetics and functionality. Here, *florism* is proposed not only as a design philosophy but also as a comprehensive approach to improving environmental efficiency and visual appeal in urban structures.

Objectives of Scientific Research. The objectives of this research include:

1. Identifying and analyzing specific floral structures, such as the receptacle, sepals, petals, stamens, and pistils, whose forms can be practically incorporated in architectural design.
2. Developing design strategies under *florism* to enhance energy efficiency, durability, and functionality in urban buildings.
3. Demonstrating the ways *florism*-inspired structures can mitigate urban environmental issues, such as heat island effects and poor ventilation, and fostering a close connection to natural aesthetics in sophisticated urban settings.

Research Methods. The study employs a combination of qualitative and analytical research methods, encompassing both a literature review and a case study analysis. The following methods were adopted to achieve the research objectives:

1. **Literature Review**: A comprehensive examination of prior works on biomimetic principles and sustainable architectural design was conducted, drawing from academic journals, architectural case studies, and technical literature on floral morphology.

2. **Case Study Analysis**: Selected architectural projects inspired by natural floral forms, including the Lotus Temple in New Delhi and the Gherkin in London, were analyzed to assess how floral structures have been adapted for achieving functionality and aesthetics in real-world applications.

3. **Comparative Analysis**: This involved a comparative study between traditional and *florism*-based architectural designs to identify the key areas of improvement in terms of energy efficiency, aesthetic appeal, and environmental adaptability.

These methods allow an in-depth understanding of the application of *florism* in architecture, demonstrating the constructional feasibility and environmental benefits of adopting floral biomimicry within urban development endeavours.

Adoption of Structural Features of Flowers in Architecture

Flowers have long captivated human imagination with their delicate shapes, vibrant colours, and sweet fragrances. *Florism* seeks to capture and embody these qualities in building designs. In such a process, architectural designs can incorporate elements such as curved shapes, organic forms, and intricate details inspired by flowers to create visually stunning and harmonious structures. By closely studying the morphology and organ functionalities of flowers (fig. 1), it is understood that *florism-based* design principles can be defined and incorporated into the construction industry.

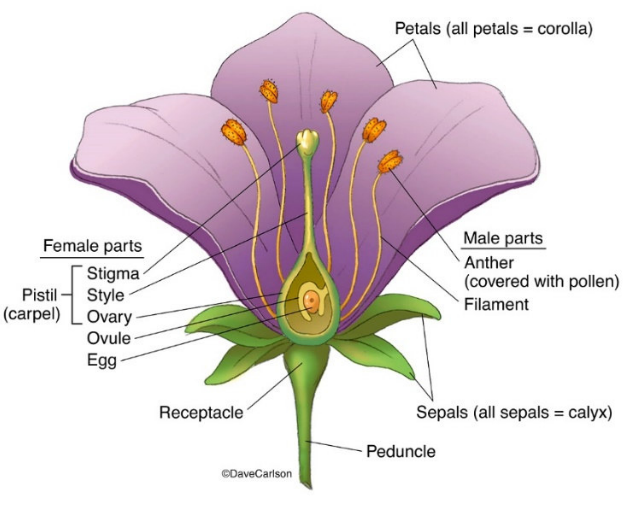

Fig. 1. Morphology of a flower. ©DaveCarlson (image source -https://www.toppr.com/ask/question/which-is-the-sequence-of-four-whorls-of-flower-from-outside-to-inside/)

Each flower essentially consists of a floral axis bearing the stamens, pistils, and accessory organs (typically sepals and petals) [6]. The flower parts are usually arrayed in whorls or arranged spirally [6]. These whorls are usually made of four separate parts: (1) an outer calyx made up of sepals; (2) a corolla made up of petals; (3) an androecium, or group of stamens; and (4) a gynoecium made up of pistils [6]. The receptacle of a flower is the base of the flower to which all the above parts are attached [6, 7, 8]. All these structural features of flowers can be used as models in developing different parts of buildings to resolve various types of environmental and functional issues [9, 10, 11].

Receptacle to Ensure Structural Integrity and Stability

Typically, the receptacle tends to be the part that supports and holds the flower together which usually helps to withstand certain harsh weather conditions [7, 8]. Accordingly, while adopting the structural features of flowers in architecture, one may find several ways to draw inspiration from the receptacle under *florism.*

1) Gathering space: A flower's receptacle acts as a focal point for the reproductive structures [7]. This concept can be translated into architectural designs by creating a central gathering space within a building, such as a courtyard, atrium, or communal area. These spaces can serve to stimulate social interactions, collaboration, and a sense of community.

2) Structural integration: The receptacle provides support and attachment for the floral organs [7, 8]. Under *florism* architects can integrate structural elements to provide support and stability. For example, columns or pillars in a building can visually represent the idea of the receptacle by providing a solid foundation and structural integrity to the overall design.

3) Functional Integration: The receptacle in a flower is responsible for providing nourishment for the developing seeds [7]. This concept can be transferred into architectural design by including practical and functional aspects that support the well-being of the building occupants. Incorporating features such as green spaces, living walls, or indoor gardens can indicate the receptacle's function of nurturing and giving a healthy living environment.

In this context, the Lotus Temple in New Delhi (Fig. 2), also known as the Bahá'í House of Worship, whose structure is inspired by the lotus flower [12] can be taken as a vital example. There each petal of the enormous lotus bloom serves as an entrance to the central prayer hall, which can accommodate several thousand visitors at a time. Thus, it not only showcases the aesthetic beauty of the flower but also utilizes sustainable design principles of receiving natural ventilation, controlling internal temperature, optimising daylight attraction, and reducing electricity consumption usually needed to operate artificial lighting and cooling systems. The building utilizes natural ventilation through openings in the upper and lower parts of the structure [12].

Fig. 1. The Lotus Temple
(image source- https://www.delhicapital.com/delhi-locations/lotus-temple-2/)

Sepals to Provide Reinforcement for Protective Cover

The protective outer layer of flowers known as the sepals surrounds the reproductive organs of the flower and their primary role is to protect the developing flower bud [6, 7]. Similarly, architects can use durable materials with thermal insulation properties such as double-skin façade technologies, double-glazed glass, or insulated panels to create a protective barrier against heat loss or gain and provide reinforcement to the building. This enhances building energy efficiency and reduces dependency on mechanical heating and cooling systems. Double skin façades consist of two class layers with a gap between them creating and air cavity. The air cavity is either sealed to retain heat in winter or ventilated for surplus heat in the summer. Solar shading devices, such Venetian blinds, are frequently employed in the space between the two skins to enhance the double skin façade's performance [13].

The Gherkin, the London (Fig. 3.) office tower designed by Foster + Partners is a prominent example of implementing a doubled skin façade [14]. The clear glass that surrounds the double skin façade zones presumes that air between the curtain wall layers will absorb solar heat, rise as a result of the stack effect, and vent to the external through small openings at the top of each two-story structural bay. The two and six-story atria are designed to draw fresh air through the structure by exploiting the pressure differences outside. This design emphasizes the mixed-mode ventilation which allows the building to be cooled mechanically and naturally [14].

Petals are often the most visually striking and vibrant part of a flower. Petals often have vivid colours to attract specific pollinators [15]. Under *florism*, there are endless possibilities to infuse the beauty and aesthetics of petals in architectural designs as well as attract visitors which will help the economic growth of the cities.

Fig. 2. 30 St. Mary Axe
(The Gherkin) (image source- https://londontopia.net/site-news/featured/30-st-mary-axe-10-interesting-facts-figures-gherkin/)

Petals in Modelling the Attractive Walls

1) Form and shape: Petals exhibit a wide range of shapes, configurations and sizes and consist of intricate patterns [15]. These features can pave the way to create curved architectural elements, such as curved walls, roofs, or façades, mimicking the sculptural beauty of petals, creating organic and flowing shapes, adding an artistic touch, and evoking the impression of being surrounded by nature's splendour.

2) Colour and visual impact: Petals are known for their vibrant colours [15, 16]. *Florism* can explore colourful materials or employ innovative techniques such as using coloured glass or artistic lighting design to mimic the vivid hues found in petals.

3) Texture and Materiality: Petals have a variety of textures, including softness, velvety smoothness, and delicate patterning [15, 16]. Textural features can be used in architectural design to create sensory richness and tactile experiences. Architects can experiment with textures that mimic the texture of petals, such as textured wall coverings and fabric panels.

4) Light and Translucency: Petals often possess a translucent quality, allowing light to pass through them [16]. By incorporating light-filtering elements such as designing spaces with large windows or glass walls to allow ample natural light to illuminate the interior spaces, mimicking the way petals capture and interact with sunlight.

"The Lotus Building and People's Park" in Wujin, China designed by Studio505 (Fig. 4.) stands as an inhabited sculpture [16]. Visitors enter from below into a cathedral dome-like interior space that creates a vibrant and cheerful ambience [17]. This is largely due to the colour gradient of the petal ribs which begins as a deep hue only at the structure's edge and fades into lighter and airier tones within [17]. 'The lotus building' is further enhanced at night, illuminated by a lighting system [17].

Another example of the optimal use of lighting can be drawn from the ArtScience Museum in Singapore (Fig. 5.), designed by Moshe Safdie, which also draws inspiration from the lotus flower, specifically its petals that gently open and embrace the sky [18]. The museum's unique shape includes ten finger-like structures, resembling lotus petals, extending from a central base [18]. These "petals" house the exhibition galleries, creating a harmonious and immersive space for visitors. The design allows natural light to penetrate the galleries, reducing reliance on artificial lighting [18]. Rainwater is collected in the dish-shaped roof of the museum, which drains through an oculus, creating a cascade that feeds an internal pond [18]. The collected water is then filtered and purified for use inside the building [18].

Fig. 4. The Lotus Building and People's Park © John Gollings
(image source- https://www.archdaily.com/521699/the-lotus-building-and-people-s-park-studio505/53ae3d38c07a80eb1c0000a5-the-lotus-building-and-people-s-park-studio505-photo)

Fig.5. ArtScience Museum, Singapore © SafdieArchitects
(image source- https://www.archdaily.com/119076/artscience-museum-in-singapore-safdie-architects/5013b1f928ba0d39630009f4-artscience-museum-in-singapore-safdie-architects-photo)

The Stamen in Modelling the Top (Stamen as functional and Aesthetic elements)

Stamen is the male reproductive part of a flower, consisting of the filament and the anther [6, 7]. Stamen offers many opportunities to integrate functional and aesthetic elements under *florism*.

1) Structural features: The stamen in a flower is usually a slender and an elongated structure [6, 7].

2) Lighting Effects: The anther, which is located at the apex of the stamen, contains pollen for the production of reproductive cells [6, 7]. Lighting can be used in architectural design to simulate the aesthetic effect of pollen dispersal.

The 7m tall chandelier in The Lotus Building and People's Park in Wujin, China (Fig. 6.) is a significant example of a structure that combines sophisticated geometry with simple details, structural efficiency, and dynamically perceived sculptural and lit form [17].

Fig. 6. The 7m tall chandelier in The Lotus Building and People's Park in Wujin, China (image source-https://www.archdaily.com/521699/the-lotus-building-and-people-s-park-studio505/53ae3f9ec07a806b4b00008a-the-lotus-building-and-people-s-park-studio505-photo?next_project=no)

Pistil as a Sustainable and Alternative Energy Source

The pistil is the female reproductive part of a flower which consists of the stigma, style, and ovary [6]. This structure allows architects to incorporate attractive but functional elements in *florism-oriented* designs.

1) Central element: the pistil is usually located in the centre of a flower which can inspire architects to design a central focal point in such a way that an imaginary pistil appears conceptually. This central point can serve as a visual anchor.

2) Sustainability and Regeneration: The pistil is essential for fertilization and seed formation in flowers [6]. The concept of the pistil can be associated with sustainability and regeneration in *florism*. Adopting the formation of the pistil, renewable energy technologies, such as solar panels or wind turbines, can be integrated into a building in an elongated vertical structure.

3) Natural Light and Ventilation: In nature the pistil facilitates pollination by allowing the stigma to open [6]. This characteristic can be expressed in architectural design by means of natural light and ventilation systems.

The Wuhan Energy Flower (Fig. 7.), designed by architect Mikhail Dikov, is an innovative energy-generating structure located in Wuhan. It is notable that it showcases the integration of pistil-inspired design principles. Its design combines multiple sustainable energy production technologies. Thousands of solar panels are used as decorations for the building's exterior [19]. Rainwater is also gathered by a flower-like canopy, stored, and used for irrigation and other non-potable purposes [19]. Wind turbines are built into the pistil sticking out of the flower [19]. Integrating solar and wind energy into a single structure allows the Wuhan Energy Flower to use both renewable energy sources simultaneously, optimizing energy production [19].

Fig. 7. Energy Flower-Institute of New Energy, Wuhan (image source- http://www.inew.cn/index.php?c=article&a=type&tid=47)

Adoption of Behavioural Patterns of Flowers in Architecture

Beyond the structural beauty and morphology of flowers, their behavioral adaptations offer a unique layer of inspiration for architectural design. Flowers exhibit a wide range of responsive actions, often driven by environmental conditions such as light, temperature, and humidity [20]. These behaviors, evolved over millennia, allow flowers to optimize their growth, energy use, and survival in diverse ecosystems [21]. Translating these adaptive traits into architectural elements introduces a new dimension to building designs, where structures can not only emulate natural aesthetics but also embody the resilience and adaptability to nature [22].

Incorporating floral behaviors into architecture aligns with biomimetic principles that aim to create buildings that react organically to their surroundings [23]. Such responsive systems in architecture can enhance sustainability, comfort, and functionality by shifting how buildings interact with natural forces. For example, by adapting heliotropic movement as seen in sunflowers, architects can create facades that follow the sun's path, optimizing natural light and thermal control throughout the day [24]. This design solution not only reduces reliance on artificial lighting and heating systems but also creates a dynamic interaction between the building and its environment, capturing the essence of natural growth and adaptation [21].

Behavioral integration in architecture also serves as a practical response to environmental challenges. In high-temperature or high-glare conditions, buildings with responsive shading inspired by floral behaviors can mitigate heat gain, reducing cooling demands and energy costs [25]. Similarly, adaptive facades that respond to wind or precipitation protect interiors from extreme conditions while enhancing the durability of the building envelope [26]. Such adaptive architecture not only conserves energy but also represents a sustainable approach to urban design, where buildings mirror the responsive, self-regulating capacities seen in nature [27].

By adopting these natural behavioral patterns, architects can redefine the relationship between buildings and their environments. Buildings can evolve from static structures into adaptable, living entities capable of interacting dynamically with external elements [28]. This approach not only amplifies the functional and aesthetic value of architecture but also fosters a sense of harmony with the natural world. Through the lens of *florism*, architecture becomes a participatory element within its ecosystem, working synergistically with environmental forces to create sustainable, resilient, and visually compelling spaces [29].

Sunflower: Solar Tracking Facades

Fig. 8. Sunflower (image source- https://www.almanac.com/plant/sunflowers)

Sunflowers (Fig. 8.) can actively follow the movement of the sun throughout the day [30, 31]. This phenomenon is known as heliotropism [30]. Architects have observed and studied this and developed sun-tracking mechanisms that adjust the position of solar panels or kinetic façades that help to improve visual and thermal comfort [30, 31]. For example, Abu Dhabi Investment Council New Headquarters – Al Bahr Towers (fig. 9) designed by architect Abulmajid Karanouh include two 150m high circular towers each with a dynamic frame consisting of shading devices made from triangular units inspired by the traditional Islamic object the "Mashrabiya" and aligned in a honeycomb pattern [30, 32]. Each individual device unfolds to various angles in response to the movement of the sun [32, 33]. The computer-controlled shading devices system allows it to react to ideal solar and lighting conditions [32, 33]. This system reduces the dependence on air conditioners in scorching hot temperatures in the UAE and provides shade and it not only provides shade but also optimizes the distribution of natural light and creates visually engaging spaces [32, 33].

Fig. 9. Al Bahr Towers (image source- https://www.archdaily.com/270592/al-bahar-towers-responsive-facade-aedas/5d5311e8284dd1737600009a-al-bahar-towers-responsive-facade-aedas-image)

Fibonacci Sequence

Numerous plant species include the Fibonacci sequence, also known as the Golden Ratio which mathematically represents the "perfection of nature" [34, 35]. Leonardo of Pisa published the Fibonacci sequence in the "Liber Abaci," or "Book of Calculus," in 1202 and his series of numbers go as follow (1, 2, 3, 5, 8, 13, 21, 34, 55, 89,….). The aligning of the sunflower seeds is a classic example for this phenomenon. The golden ratio has been repeatedly used in many architural designs throughout the history such as Taj Mahal, Parthenon [35].

The inspiration for the core building (Fig. 10.) of the Eden project designed by Jolyon Brewis of Nicholas Grimshaw and Partners was drawn by studying the spirals of the sunflower, pinecones and pineapples [36]. Fibonacci Spirals can be observed in the core roof and there are skylights to capture the sunlight. There are solar panels fixed on the core roof. The building was meant to be energy-efficient, suited for its intended use, future-proof, manufactured with materials obtained sustainably, and built with minimal waste [36].

Fig. 10. The Eden Project: The Core roof
(image source-https://grimshaw.global/projects/gallery/?i=578&p=03126_N349_a3)

Lotus: Purity and Ultra-Hydrophobicity

Fig. 11. Lotus Flower
(image source- https://bouqs.com/blog/lotus-flower-meaning-and-symbolism/)

While lotus flowers (fig. 11) do not display notable behaviours like sunflowers, their unique characteristics and symbolism have inspired *florism-oriented* design principles [37]. Lotus flowers are sacred in both Buddhism and Hinduism [37]. They stand for purity, enlightenment, and rebirth, and have deep cultural and symbolic significance in many countries [37]. The symbolism of lotuses can be used to create buildings that express serenity, harmony, and spiritual connections. Lotus flowers have elegant yet curving shapes that can influence the arrangement and contour of architectural designs. To replicate the soft arcs and arcing lines present in the petals, leaves, and seed pods of lotus flowers, architects can use lotus-inspired architectural features. This can be portrayed by curved building facades, winding streets, or fluid internal spaces, which add visual appeal and foster a sense of organic fluidity. Lotuses emerge within the water and typically remain unaffected by dirt or contamination there [37]. Water features like ponds, reflecting pools, or even wetland gardens can be used under *florism* architecture. These components not only relate to the lotus flower's natural environment but also foster biodiversity, serenity, and act as a symbol of life's ongoing regeneration.

The People's Park surrounding the Lotus building also features extensive green space reflecting the natural environment conducive for the Lotus to thrive [17]. More than 2,500 geothermal piles have been driven into the base of the artificial lake that surrounds the structure. The entire water mass of the lake and the ground beneath it is used for the precooling (summer) and preheating (winter) air conditioning systems for the Lotus and the two-storied building beneath the lake [17].

The lotus tower in Colombo, Sri Lanka (Fig. 12) is another symbolic landmark. The 350m high tower resembles a blooming lotus bud and is covered with a series of overlapping petals [38]. Its stands out in the city with its vibrant colours and illuminates at night.

Fig. 12. The Lotus Tower
(image source- https://www.flickr.com/photos/pocheco/45763101934/in/photostream/)

The "lotus effect," or ultra-hydrophobicity, is a property of lotus leaves [37]. This ultra-hydrophobicity trait could ensure that the leaf's upper epidermis is not submerged in water. Ultra-hydrophobicity is thought to have served the lotus well in its evolutionary development as a result. Studies have revealed that it is accomplished by a unique dense coating of waxy papillae on the surface of the lotus leaf [37]. Many research projects have been conducted to create highly durable, self-cleaning ultra-hydrophobic coatings which can resist staining and reduce maintenance needs [37].

Morning Glory: The Circadian Rhythm

Fig. 13. Morning Glory
(image source- https://www.almanac.com/plant/morning-glories)

Morning glory (Fig. 13.) is known for its circadian rhythm of opening in the morning and closing in the evening. The circadian rhythm roughly follows a 24-hour cycle [39]. Light is primarily responsible for causing Morning Glory flowers to open and close. Blue light wavelengths in particular are quite sensitive to variations in light intensity for flowers. Morning exposure to sunlight or artificial light causes flowers to quickly open their petals in response. In the evening or when it's gloomy, they close their petals. In addition to light, environmental factors like temperature and humidity can also affect how Morning Glory flowers behave. The timing and length of their daily cycle may be impacted by extreme temperatures or adverse humidity levels [39]. The Morning Glory flower's circadian rhythm is adaptable and has multiple functions such as drawing pollinators, including bees and butterflies, who are more active during the day [39]. The flowers preserve energy, protect their reproductive structures from harm, and shield themselves from nocturnal herbivores by closing up at night [39]. This can be incorporated in *florism-oriented* designs by creating responsive facades that mimic these behavioural patterns. These responsive facades can optimise natural lighting, control solar heat gain, and enhance energy efficiency in buildings.

Future Directions and Innovations in *Florism*-Based Architecture

As the architectural field continues to evolve, *florism* opens doors to a new frontier where aesthetics, functionality, and environmental responsibility converge. Future innovations in *florism*-based architecture may capitalize on advanced technologies and materials, allowing buildings to behave more like natural organisms, responsive to both immediate and long-term environmental needs [40]. With an emphasis on sustainability and resilience, *florism* offers promising pathways to redefine how architecture interacts with its surroundings and adapts to the pressing challenges of urbanization and climate change [40].

One potential direction for *florism* lies in advanced biomimetic materials that mimic the specific properties of floral structures. For instance, ultra-lightweight composites that replicate the cellular structure of petals could provide high strength with minimal material use, reducing resource consumption in constructions [41, 42]. Additionally, the creation of hydrophobic and self-cleaning surfaces inspired by the lotus effect could greatly reduce maintenance needs and enhance durability, particularly in urban settings with high pollution. Research into these materials, including developments in bioengineered textiles and 3D-printed organic structures, could enable architects to produce building facades and components that inherently resist weathering, repel dirt, and support passive climate control [41].

Integration of Artificial Intelligence (AI) and Smart Systems is another promising avenue for *florism*-based architecture. With AI, buildings can become "intelligent," adapting autonomously to changing environmental conditions in real time [43]. Inspired by the way flowers respond to light and temperature, AI-driven systems could control dynamic shading, ventilation, and even water distribution to optimize energy efficiency and occupant comfort. For example, sensors that detect sunlight or temperature changes could automatically adjust window opacity, much like petals opening and closing in response to sunlight. The development of such intelligent, adaptable systems transforms buildings into responsive, self-regulating ecosystems, reducing energy use and supporting the well-being of occupants [43, 44].

Expanding *florism* to urban planning and green infrastructure also holds significant potential. Applying *florism* at an urban scale, architects and planners could design entire neighborhoods or districts that emulate natural ecosystems [45]. *florism*-inspired planning would prioritize green corridors, rooftop gardens, and interconnected spaces that encourage biodiversity and facilitate ecological networks within cities [45]. Buildings designed under *florism* principles could integrate seamlessly with urban greenery, promoting air purification, reducing urban heat, and creating pleasant environments for city dwellers. Such an approach fosters sustainable communities where urban design is in harmony with local flora, providing valuable ecological and social benefits [45].

Incorporating renewable energy solutions inspired by floral structures represents yet another innovative approach. Flowers efficiently capture sunlight, water, and nutrients, often storing or redistributing them as needed. Following this model, buildings could employ renewable energy systems that mimic these natural processes, such as solar panels arranged in petal-like configurations to maximize exposure and energy capture [19, 32]. The concept of energy storage and distribution could be modelled after plant nutrient systems, with energy captured during peak sunlight hours stored in integrated batteries for later use, optimizing energy availability while reducing grid dependency [46].

As climate change and urbanization continue to impact global cities, *florism*-based architecture provides a visionary yet practical solution for the future [1]. By drawing on the adaptive qualities and efficiency of flowers, architects can design structures that enhance ecological balance and foster resilient, sustainable communities. The future of *florism*-based architecture lies in our capacity to merge the wisdom of nature with technological advancements, forging a path toward an urban landscape that breathes, grows, and evolves in harmony with the natural world [9, 10].

Conclusions. The above study was inspired by sensitivity to environmental issues the present architectural mechanisms have created, turning the concept of urbanization into a process of creating concrete jungles filled with torturous eyesores. As a solution to the present crisis, biomimetics has evolved in a small way in certain parts of the world through the involvement of architects and engineers who have a humanitarian bent in civil engineering and the construction industry. The identification of floral morphology along with the external organic structures of flowers such as the lotus, sunflower, and morning glory, together with their imaginative use for designing various constructional components of a building is what has been attempted in the discussion above. The new concept presented here in terms of *florism* represents a new dimension of biomimetics. There, all provisions of biomimetics are observed but under the structural designs of flowers. Accordingly, it is claimed that all constituents of flowers are found usable in modelling structural and functional features of buildings designed under *florism*. In fact, in the construction sector rigid structures are much easier to build up than organic ones. That means, in terms of executing the concrete work, it poses challenges to civil engineers. Yet if such intricacies are overcome, the outcome of the effort will have long-lasting benefits. The costs incurred in the construction can be easily recovered in the process of mobilisation and maintenance of the buildings that emerge under the rationale of this innovative design principle.

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Поступила 17.07.2024 г.

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ФЛОРИЗМ: ОБЪЕДИНЕНИЕ БИОМИМЕТИЧЕСКОЙ АРХИТЕКТУРЫ С РАЗНООБРАЗНЫМИ ЦВЕТОЧНЫМИ СТРУКТУРАМИ

Аннотация. *Биомиметика в архитектуре, вдохновленная структурными особенностями различных природных образований биосферы, помогает создать методологическую основу для принятия и преобразования биологических стратегий в проектные инновации. В связи с этим в статье под новым термином "флоризм" представлена новая концепция, рассматривающая принцип проектирования, ориентированного на устойчивое развитие, который сформировался в духе включения различных частей цветов в архитектурные проекты с эстетическим и конструктивным восприятием их структурных и функциональных качеств. В данной работе приводятся примеры из нескольких существующих архитектурных проектов, вдохновленных формами и функциями цветов, с целью обоснования прикладных решений, которые могут быть разработаны для обеспечения функциональности и устойчивости зданий, спроектированных в рамках флоризма. Кроме того, в статье рассматриваются инновации в строительной индустрии в рамках флоризма, которые могут повысить эстетическую и функциональную эффективность архитектурных проектов в целом.*

Ключевые слова: *флоризм, биомиметическая архитектура, устойчивый дизайн, энергоэффективность, биомиметические принципы, архитектура и цветы.*

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Received 17.07.2024

Для цитирования:
Фонсека Э.А.Г., Романов О.С. Флоризм: объединение биомиметической архитектуры с разнообразными цветочными структурами // Вестник БГТУ им. В.Г. Шухова. 2025. № 3. С. 68–81. DOI: 10.34031/2071-7318-2024-10-3-68-81

For citation:
Fonseka E.A.G., Romanov O.S. Florism: fusing biomimetic architecture with diverse flower structures. Bulletin of BSTU named after V.G. Shukhov. 2025. No. 3. Pp. 68–81. DOI: 10.34031/2071-7318-2024-10-3-68-81