

Enhancing Residential Architecture through Generative Design: Balancing Aesthetics, Legal Constraints, and Environmental Considerations

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Abstract : This research paper presents an in-depth exploration of the use of generative design in urban residential architecture, with a dual focus on aligning aesthetic values with legal and environmental constraints. The study aims to demonstrate how generative design methodologies can innovate residential building designs that are not only legally compliant and environmentally conscious but also aesthetically compelling. At the core of our research is a specially developed generative design framework tailored for urban residential settings. This framework employs computational algorithms to produce diverse design solutions, meticulously balancing aesthetic appeal with practical considerations. By integrating site-specific features, urban legal restrictions, and environmental factors, our approach generates designs that resonate with the unique character of urban landscapes while adhering to regulatory frameworks. The paper places emphasis on algorithmic implementation of the logical constraint and intricacies in residential architecture by exploring the potential of generative design to create visually engaging and contextually harmonious structures. This exploration also contains an analysis of how these designs align with legal building parameters, showcasing the potential for creative solutions within the confines of urban building regulations. Concurrently, our methodology integrates functional, economic, and environmental factors. We investigate how generative design can be utilized to optimize buildings' performance, considering them, aiming to achieve a symbiotic relationship between the built environment and its natural surroundings. Through a blend of theoretical research and practical case studies, this research highlights the multifaceted capabilities of generative design and demonstrates practical applications of our framework. Our findings illustrate the rich possibilities that arise from an algorithmic design approach in the context of a vibrant urban landscape. This study contributes an alternative perspective to residential architecture, suggesting that the future of urban development lies in embracing the complex interplay between computational design innovation, regulatory adherence, and environmental responsibility.

Keywords : generative design, computational design, parametric design, algorithmic modeling

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