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ENERGY EFFICIENT BUILDING FAÇADE DESIGN USING FUZZY MULTI-CRITERIA DECISION METHOD IN TEMPERATE AND HUMID CLIMATE OF IRAN

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Abstract

Thermal and energy performance optimization are the requirements in the construction of every building. Despite the significant potential of façades to improve the residential buildings' energy performance and the comfort level of the occupants, it is not well studied in the design stage. This is related to the need for satisfying different design criteria that make the design process drastically complicated. The application of multi-criteria decision-making is a useful tool to help designers integrate several inconsistent criteria, as they generate the best solutions for achieving contradictory and compound objectives. This study presents a building envelope design optimization through coupling a fuzzy analytic hierarchy process and Buckley geometric mean method with the survey of experts to provide new and simplified guidelines for designers in achieving high-performance façade systems in the temperate and humid climate of Iran. Data on seven indicators that could reflect the energy performance of a building were analysed. The results show that among the studied criteria, the professionals are more concerned about the building orientation as the most effective criteria for energy consumption (weight 0.231), followed by wall materials (weight 0.192), window-to-wall ratio (weight 0.152), windows' glass materials (weight 0.122), shading design (weight 0.115), using natural ventilation (weight 0.106), and the type of interior curtains (weight 0.083) that gained the seventh rank. The application of these results offers a guideline for potential passive residential building designs in temperate climates and contributes to sustainable development.

Key words: energy saving, façade design, fuzzy multi-criteria decision-making, Iran

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