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Multi-Factor Optimization Method through Machine Learning in Building Envelope Design: Focusing on Perforated Metal Façade

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Abstract : Because the building envelope has a significant impact on the operation and maintenance stage of the building, designing the facade considering the performance can improve the performance of the building and lower the maintenance cost of the building. In general, however, optimizing two or more performance factors confronts the limits of time and computational tools. The optimization phase typically repeats infinitely until a series of processes that generate alternatives and analyze the generated alternatives achieve the desired performance. In particular, as complex geometry or precision increases, computational resources and time are prohibitive to find the required performance, so an optimization methodology is needed to deal with this. Instead of directly analyzing all the alternatives in the optimization process, applying experimental techniques (heuristic method) learned through experimentation and experience can reduce resource waste. This study proposes and verifies a method to optimize the double envelope of a building composed of a perforated panel using machine learning to the design geometry and quantitative performance. The proposed method is to achieve the required performance with fewer resources by supplementing the existing method which cannot calculate the complex shape of the perforated panel.

Keywords : building envelope, machine learning, perforated metal, multi-factor optimization, façade
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