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Intelligent Multi-objective Optimization for Building Energy and Comfort Management

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Abstract

The rapid economic and population growth in developing countries, effective and efficient energy usage has turned out to be crucial due to the rising concern of depleting fossil fuels. Of which, one-third of primary energy is consumed in buildings and expected to rise by 53% up to 2030. This roaring sector posing a challenge, due to 90% of people spend most of their time in buildings; requires enhanced well-being of indoor environment and living standards. Therefore, building operations requires more energy because most of the energy is consumed to make the indoor environment comfortable. Consequently, there is the need of improved energy efficiency to decrease energy consumption in buildings. In relation to that, the primary challenge of building control systems is the energy consumption and comfort level are generally conflicting to each other. Therefore, an important problem of sustainable smart buildings is to effectively manage the energy consumption and comfort and attain the trade-off between the two. Thus, smart buildings are becoming a trend of future construction that facilitates intelligent control in buildings for the fulfillment of occupant's comfort level. In this study, an intelligent multi-objective system has been developed with evolutionary multi-objective genetic algorithm (MOGA) optimization method. The corresponding case study simulation results for the effective management of users' comfort and energy efficiency has been carried out. The case study results shows the management of energy supply for each comfort parameter and maintains high comfort index achieving balance between the energy consumption and comfort level.

Keywords: Energy, buildings, comfort, management, optimization, trade-off.