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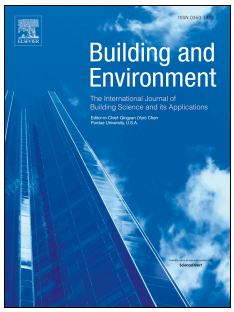

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Exploring the “black box” of thermal adaptation using information entropy

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Abstract:

Thermal adaptation has been well interpreted well by behavioral, physiological, and psychological factors, but the mechanism and interaction between the three factors remain in a “black box”. This paper aims to apply the general system theory and information entropy to investigate the quantitative relationships of the three thermal adaptation processes. Based on the database from the field survey and laboratory experiments conducted in the hot summer and cold winter climate zone (HSCW) of China, three typical adaptive indices: clothing insulation (Clo), thermal sensation votes (TSV), and sensory nerve conduction velocity (SCV) were selected to calculate Clo entropy, TSV entropy, SCV entropy, and total entropy. The regression models were developed between these entropies and the indoor air temperature to quantify the weights of the three adaptive categories. The models were used to compare the differences between China and Pakistan as well as between adaptive approaches and climate chamber experiments. The comfort and acceptable temperature ranges for the HSCW zone were obtained using the entropy models. Our findings propose a new perspective using entropy to quantify the behaviorally, physiologically, and psychologically adaptive approaches, which contribute to a better understanding of opening the “black box” of thermal

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