

Producing Outdoor Design Conditions based on the Dependency between Meteorological Elements: Copula Approach

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Abstract : It is common to use the outdoor design weather data to select the air-conditioning capacity in the building design stage. The outdoor design weather data are usually comprised of multiple meteorological elements for a 24-hour period separately, but the dependency between the elements is not well considered, which may cause an overestimation of selecting air-conditioning capacity. Considering the dependency between the air temperature and global solar radiation, we used the copula approach to model the joint distributions of those two weather elements and suggest a new method of selecting more credible outdoor design conditions based on the specific simultaneous occurrence probability of air temperature and global solar radiation. In this paper, the 10-year period hourly weather data from 2001 to 2010 in Osaka, Japan, was used to analyze the dependency structure and joint distribution, the result shows that the Joe-Frank copula fit for almost all hourly data. According to calculating the simultaneous occurrence probability and the common exceeding probability of air temperature and global solar radiation, the results have shown that the maximum difference in design air temperature and global solar radiation of the day is about 2 degrees Celsius and 30W/m², respectively.

Keywords : energy conservation, design weather database, HVAC, copula approach

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