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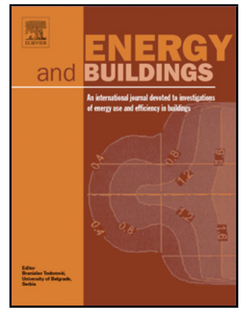

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Uncertainty Analysis of Thermal Comfort in a Prototypical Naturally Ventilated Office Building and Its Implications Compared to Deterministic Simulation

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Abstract

Naturally ventilated buildings utilize the effect of natural winds and buoyancy for supplying and removing air within a building. Such buildings are attractive to building owners because they reduce cooling energy costs and can supply the required amount of fresh air without the need for fans. Because of the latter, they are often viewed as a way to improve occupant comfort and produce a healthier indoor environment. In practice, there are situations where a building can fully rely on natural ventilation for cooling and fresh air, although in most cases the installed mechanical cooling can take over when natural cooling is insufficient to keep spaces comfortable. Despite the inherent risks in some buildings that have no mechanical cooling, typically the risks of overheating are mild to moderate based on design assessments. In reality, however, these buildings sometimes don't meet their expected performance and have extended periods of overheating resulting in discomfort and in some cases serious complaints and lawsuits. One reason for such unexpected underperformance could be that design assessments are typically based on deterministic predictions (using simulation) that do not consider the effect of the variability in influencing factors, such as the building microclimate, building properties, usage patterns, etc. The compounding effect of these sources of uncertainty needs to be inspected to fully explore the risks that occupant thermal comfort might not be maintained for certain periods. In this study, we propose to use a probabilistic prediction approach to assess thermal comfort of a naturally ventilated