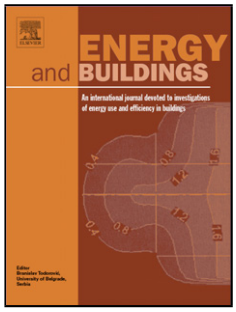

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Lighting and cooling energy assessment of multi-purpose control strategies for external movable shading devices by using shaded fraction

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Highlights

- Shading control algorithms for exterior movable shading devices were developed considering shaded fraction
- Algorithm includes three different shading control modes; energy conservation (mode 1), glare protection and energy conservation (mode 2), and glare protection, illuminance satisfaction and energy conservation (mode 3)
- Real-scale mock-up test was performed, and the lighting and cooling energy performance of three control modes were analyzed and discussed

Abstract

External movable shading devices are mainly used to improve the thermal and lighting environment of an interior space by preventing overheating during the cooling season as well as by preventing glare. An external movable shading device can be controlled using various methods, where parameters related to the lighting environment, such as daylighting and glare, are commonly adopted as major variables associated with the control of the shading device. In this paper, an algorithm is provided with which an external movable shading device can be operated in any one of three control modes as selected according to the operation purpose preferred by the occupant. The algorithm can be applied to external movable shading devices of various shapes. The shaded fraction is adopted as a major control element, and the control purpose of the external shading device is configured to include energy conservation, illuminance satisfaction, and glare protection. The algorithm includes an hourly evaluation procedure for obtaining the range of allowable shading device movement that satisfies each of the three operation purposes. Real-scale mockup tests for the three control modes were conducted during different time periods in summer to verify the performance of the control strategies. The test results regarding the energy and environment performance for each control mode show that the control algorithm can be selected to provide satisfactory compromises between energy and visual comfort factors. The result of this study can provide users with options for controlling movable shading devices on a building according to their preferred operation purposes.