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DAYLIGHTING 'ENERGY AND COMFORT' PERFORMANCE IN OFFICE BUILDINGS: SENSITIVITY ANALYSIS, METAMODEL AND PARETO FRONT

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Abstract

Daylighting performance is an integral feature of sustainable building design. In this paper, two performance criteria were defined, namely an annual glaring index (AGI) and an annual energy requirement for lighting (AEL). Based on 1900 daylight simulations of an office building located in Montreal (Canada), a sensitivity analysis was performed to identify the most influential building design variables among a list of 15. Two sensitivity analysis techniques were employed. Window-to-wall ratios and the overhang dimension were among the most influential parameters for both AEL and AGI, whereas building orientation and aspect ratio, as well as visible transmittance, were found to have a relatively weak influence. A Pareto front demonstrating the optimal tradeoffs between AEL and AGI was approximated from the simulation sample. Finally, a metamodel is developed to calculate rapidly the daylight performance indices for a given set of the 15 design variables.

Keywords: daylight; energy consumption; glare; metamodel; sensitivity analysis; building design

Nomenclature

AEL	annual energy for artificial lighting, (klm-h)/m^2
AGI	annual glaring index
b_{Xi}	linear regression coefficient for each design variable
B_k	window still position for each façade, % of 'available' façade height
CV	coefficient of variation, %

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