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INTRODUCTION

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Advances in daylight simulation research

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The JBPS archives offer a telling list of papers on the development of daylight simulation. From the founding stones of annual daylight simulations, better known as Climate-Based Daylight Modelling (CBDM; Laouadi, Reinhart, and Bourgeois 2008; Mardaljevic 2008), to refined methods for simulating complex optical properties using *Radiance*-based ray-tracing (McNeil and Lee 2013) or photon-mapping (Schregle, Grobe, and Wittkopf 2016) techniques. Balancing computation time and accuracy – especially for assessing visual comfort – is at the core of several studies. Papers explored the generation of optical functions to describe complex shading devices using photon-mapping (Grobe 2019) and GPU-based processes for faster ray-tracing and real-time response (Jones and Reinhart 2019). Other papers investigated in depth the accuracy of input geometry (e.g. the modelling of trees (Al-Sallal and Al-Rais 2013) and varying levels of detail in façades (Agarwal, Pastore, and Andersen 2024)) and optical properties (e.g. material reflectance (Brembilla, Hopfe, and Mardaljevic 2018)). Using data from real spaces to train machine learning models is an alternative to detailed simulations (Liu, Colburn, and Inanici 2020) that has gathered momentum in recent years, especially for the design of daylight-linked control strategies (Jo, Choi, and Park 2023; Katsanou, Alexiadis, and Labridis 2019). At the same time, research and discussions on CBDM metrics flourished, with the ambition of finding quantities and thresholds that well correlate to human's visual experience (Nezamdoost and Van Den Wymelenberg 2017). The latest developments in daylight simulation follow discoveries on the physiological and psychological (i.e. non-visual) effects of light on human's health and wellbeing. Papers investigated tools that can simulate the spectral nature of visible light and new metrics related to circadian effects (Pierson, Aarts, and Andersen 2023), as well as the combined effect of daylight and access to views on façade form finding (Pouyanmehr et al. 2022). Emerging concepts on reuse and circularity of facades are also being combined with daylight and solar performance (Dervishaj and Gudmundsson 2025). The challenge that lies ahead for daylight simulation is the seamless integration of these new variables and indicators within fast, dynamic annual assessments that can achieve the desired temporal and spatial resolution.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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