Abstract

Mohamed - Ayoub

Metaheuristic Optimization of Daylighting and Energy Performances in Office Spaces

The direction towards sustainable development challenges the designers to explore energy-efficient designs to provide adequate levels of natural daylighting. Indeed, using computational simulations can offer valuable performance predictions still, exploring all possible combinations of design variables is a tedious and time-consuming task. This type of problems also doesn’t yield straightforward mathematical forms, and using black-box optimizations is more useful. This paper presented reviews, methodological tools and measures to help designers evaluating the potential contribution of simulation-based metaheuristics to optimize the design of façades in such obstructed contexts. The tested metaheuristics algorithms showed promising potential to attain optimum solutions, though the results confirmed that Genetic Algorithm was not sensitive to population size for optimizing façade design problems, as it obtained optimum designs only after conducting several runs of simulations. In contrast, Particle Swarm Optimization exhibited a higher sensitivity towards swarm sizes, where it converged much faster with larger swarm sizes and a better performance could be achieved when the swarm size was 10 times the number of design variables alongside 0.2 particle’s velocity. This implies that metaheuristics optimization can be used along with simulations as accelerated tools in the early stages of design to rapidly predict building performances in obstructed environments.