Pioneering Daylighting Design Tool to combine Architectural Form with Advanced Technology : The LightSolve Project

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Abstract

This project aims at developing a highly innovative computational tool for daylighting design that employs an inverse approach to support the design process: it will help develop a form based on both aesthetical and technical indications of the desired performance. These unprecedented capabilities will allow architects to explore a wide range of design alternatives in a very efficient way, refining the objectives they want to achieve while broadening the range of design solutions. The fascinating dynamic nature of daylight will be realistically accounted for by showing how conditions vary over time in a both visually striking and physically accurate way, while the most recent technological advances in building façades and light redirecting materials will be made available to the user. The pioneering inverse approach in computer-aided design, combined with these notable innovations at both the visual and technical levels, will undoubtedly bring highly valuable new potentialities to the architecture profession.

Several major issues will need to be addressed in this long-term project, including: what kind of metrics are appropriate to provide a comprehensive and synthetic assessment of the daylighting performances of a building project (both from a qualitative (aesthetic) and a quantitative (energy savings, visual comfort) aspects) but still account for their variability over time and space, and their dependence on location and climate; what kind of graphical and visual representation of the results would be most adequate and efficient in the decision-making process about a design; what is the most satisfactory balance between image resolution, results accuracy and interactivity; what optimization method could handle the large number of parameters, goals and constraints relating to geometry, materials, illumination conditions etc.) and help the designer in his form-finding process with a quick and transparent feedback.

The development phase described in this proposal relates to the graphical representation of the chosen metrics: how can a whole year worth of data be displayed in an interactive, synthetic and highly visual way such that an architect is able to make an informed decision about a design option over another and quickly get the information he needs about its daylighting performances and consequences on comfort, aesthetics and sustainability issues.