

Popular summary

Daylight is a sustainable and economical strategy to reduce energy consumption. Currently, many buildings have a high consumption of electricity due to the use of artificial lighting during hours of daylight. This is caused because the architectural design did not contemplate the use of daylight. Since the geometry and other architectural elements such as windows, are not possible to modify cost-efficiently or easily a solution is to redirect the daylight towards the spaces that require illumination. This will improve the daylight access, and therefore it will reduce the energy consumption. It has also other advantages over artificial lighting, such as improving the health and performance of the building occupants.

Reflectors are high reflective surfaces to redirect sunlight or daylight in buildings. However, a long study is required to assess the reflectors correct position and characteristics. There are tools to automatize the process, yet it is time consuming and inefficient for preliminary studies. The development of a tool to fast achieve accurate results is, therefore a need and the goal of this thesis.

The methodology explained here allows consultants to assess a single characteristic optimal and accurately values without investing the time to perform parametric study. This methodology, basically, pre-generates multiple possibilities and keeps the results accessible in a spreadsheet tool. The tool shows the optimal tilt to the user's inputs conditions by comparing them to the obtained by pre-generated possibilities.

In this thesis, the goal is to improve the daylight performance in a courtyard by installing reflectors by developing a methodology. The methodology allows to create a spreadsheet tool to assess the optimal tilt of the reflector for annual and monthly periods of time.

The tool results was compared with the results from a parametric study to assess the optimal tilt in a fixed reflector. The comparison showed that the tool was accurate in the tilt calculation and that reflectors are efficient in the Copenhagen area. Reflectors are especially efficient for the winter season when the sun position is low and therefore the solar light does not reach the floor of the courtyard. Therefore, the annual optimal tilt does not coincide with the specific optimal tilt for a particular season or month of the year. Efficient reflectors can improve daylight performance and thus reduce electricity demand for artificial lighting. Furthermore, people feel better by having daylight in their working and living spaces instead of using exclusively artificial lights.

This thesis explains how the methodology was developed in several steps. First, the factors influencing daylight and reflector systems were identified. Then, the results of daylight simulations with and without reflectors were compared to assess the reflectors influence on the daylight performance in the courtyard. Finally, the results were compiled in a database to access from the tool and obtain particular cases results.