• Signify

Master project: Mixed optimization in lighting design

Problem description

Luminaires need to be placed and directed in a free space such that 1) requirements are optimally fulfilled and 2) the solution is of interest. Luminaires emit a defined light distribution which means an intensity that varies over angles.

The degrees of freedom for the optimization are: the number of luminaires (discrete), the type of each luminaires (discrete), the x, y, z position of each luminaire (continuous), and the $\theta\phi$ orientation of each luminaire (continuous). Sometimes the degrees of freedom may have constraints such as number of luminaires is fixed to 8, luminaires xy coordinates are constrained to lie on a line, or θ cannot be larger than some value.

The resulting design needs to fulfill a set of requirements which are in general non-linear. Examples are:

- Minimum of light over measurement points needs to be above a certain value.
- Average of light over measurement points need to be above a certain value

A lighting design that fulfills the

requirements can be attractive for various reasons. One reason may be costs which can be driven by the number of required poles, the height of the poles, and the number of luminaires. Other reason can be to have the highest average lux or the highest uniformity or an amount of symmetry.



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Assignment

Develop an algorithm that takes as input constraints on degrees of freedom, a list of

requirements, and a list of preferences; and compute an optimal lighting design within 5 minutes on a compute-server when the number of degrees of freedom is 30. Of importance is that the algorithm can also deal with e.g. 500 degrees of freedom (scalability). A method of interest is have a table of lighting designs present, select a few designs that are close to the problem at hand, and perform local optimization.

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Contact fetze.pijlman@signify.com

