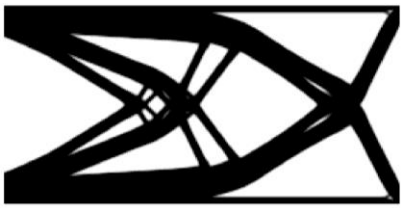
Shape optimization of light sources with global illumination objectives

In this project, we aim to apply shape optimization methods to design light sources, for example LED panels, such that they fulfil various functional requirements in real-world situations.

Topology and shape optimization methods have gained a lot of attention in the structural mechanics community, and are most commonly used for designing light-weight load bearing structures (such as the example on the right).



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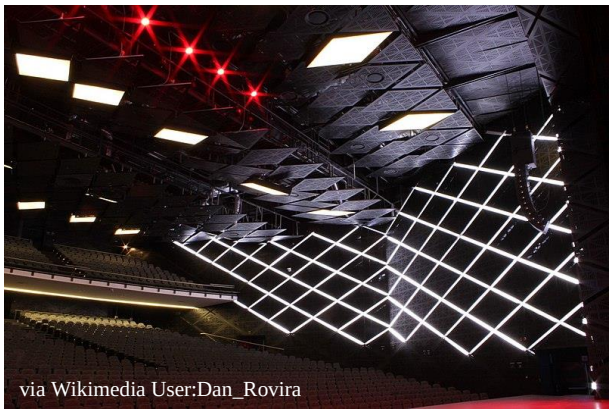
We would like to apply similar tools to design light sources, or an arrangement of multiple light sources, such as to illuminate a virtual scene in the best possible way. To this end, we plan to employ ray tracing to simulate global illumination in a scene with multiple light sources and realistic materials.

Recent advances in differentiable light transport simulation allow for efficient evaluation of objective function gradients enabling the use of fast optimization methods to address these computational problems. Applying custom regularization functions during the optimization could enable such methods to produce artistically interesting lighting designs as inspired by the images below.

For this project, we are looking for students with good C++ skills, a background in computer graphics and interest in GPU-accelerated ray tracing and mathematical optimization methods.

via Wikimedia User:Martin_Falbisoner



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