# Bachelor / Master Thesis

Raytracer for the Simulation of Solar Tower Power Plants

Course of study: Mathematics, Computer Science, Computational Engineering
Kind of thesis: Programming, Simulation, and Optimization
Programming language: C++
Start: Winter term 2019/20

Topic

In this project we are looking at solar tower power plants. The principle of concentrating solar thermal

power plants seems to be very simple: Large mirrors are used to concentrate rays of sunlight on an receiver where a fluid (e.g. molten salt) is being heated up. The heat of the fluid is exchanged into steam which powers a turbine to generate electricity.

The placement of the mirrors may lead to individual mirrors being blocked and shaded; this affects the efficiency of the power plant. The model is later used for an optimization process which finds the most efficient arrangement of mirrors.
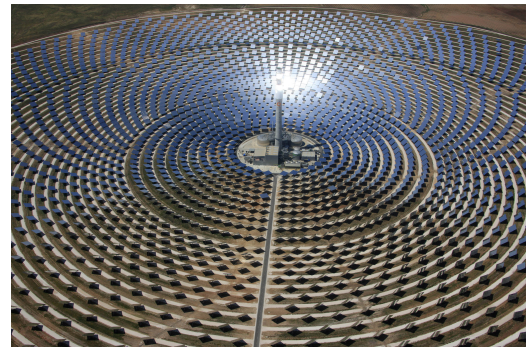
Solar tower power plant Gemasolar in Spain.

Preliminary work

A simple Monte Carlo raytracer model is already implemented in C++.

Tasks

The solar tower model considers many effects which are necessary for an accurate simulation. But there are still some improvements which need to be solved within this project:

The following tasks have to be solved:

- Validate the Monte Carlo raytracer against third-party tools called *SolTrace* and *tonatiuh*.
- Develop a multi-Monte Carlo raytracer, quasi-Monte Carlo raytracer, convolution raytracer, and a cellwise convolution raytracer.
- Accelerate the model by investigating the accuracy in depency of the raytracer technique, the number of rays, and the resolution of the receiver cells.
- Implement a GPU raytracer and test against the other raytracer.

Contact   This project is offered by the *Theory of Hybrid Systems* (i2) research group headed by Prof. Dr. Erika Ábrahám and will be co-supervised by Dr. rer. nat. Pascal Richter. For further questions please contact us via email:

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