Bachelor / Master Thesis
Heuristic Layout Optimization for Solar Thermal Power Plants

Course of study: Mathematics, Computer Science, Computational Engineering
Kind of thesis: Programming, Simulation, and Optimization
Programming language: C++
Start: 2022

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.

Preliminary work
There exists already a fast implementation of the solar tower model in C++.

Tasks
So far, patterns are used for the layout optimization of heliostats in solar tower plants. The following tasks have to be solved:

- Develop patterns for Cornfield, Hexagonal Grid, Radial Staggered Grid, Biomimetic (Spiral), Contracted Honeycomb and Dense Packing.
- Extend the existing methods with elliptic stretching parameters.
- Accelerate the interface between the model and the optimizer.
- Compare the solutions of all patterns.
- Set up a multi-step optimization approach by using patterns in a first step, and local search in a last step (for refinement).

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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