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Theory of Hybrid Systems
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Diploma thesis

Solar tower heliostat field optimisation with genetic algorithm

Course of study:	Computer Science
Kind of thesis:	Programming and Simulation
Programming language:	C++
Start:	October 2012

Problem

Solar towers use many flat mirrors to concentrate sun light on a central, tower-mounted receiver. The receiver then transfers the resulting heat to a fluid (i.e. molten salt or air) that, in turn, exchanges the heat to steam. The steam then powers a turbine, generating electricity. The placement of the mirrors may lead to individual mirrors being blocked and shaded; this affects the efficiency (and therefore costs) of the power plant. The thesis' goal is to find the most efficient arrangement of mirrors that balances power production against construction costs.

Solar power plant PS10 in Andalusia, Spain.

Preliminary work

A raytracer model is already implemented. The model computes the incoming sun rays at the receiver in terms of the sun's position. Shading, blocking and the sun shape are also modeled.

Task

In the thesis, the arrangement of the mirrors shall be optimised so that over a single year the maximum possible sun energy is received. Other objective functions shall be developed and implemented (i.e. levelised electricity costs), so that possibly the model must be extended. For the optimisation, a genetic algorithm can be used. The program shall be implemented in C++ and parallelised with OpenMP.

Supervision

This project is a corporation of the *Theory of Hybrid Systems* (i2) research group headed by Prof. Dr. Erika Ábrahám, and the *Computational Nuclear Engineering* (MathCCES) research group headed by Prof. Dr. Martin Frank. The project will be supervised by

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