

Multi-Mirror Array Calculations With Optical Error

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Abstract

The optical performance of a 2-axis solar concentrator was simulated with the COMSOL Multiphysics® software. The concentrator consists of a mirror array, which was created using the application builder. The mirror facets are preconfigured to form a focal point. During tracking all mirrors are moved simultaneously in a coupled mode by 2 motors in two axes, in order to keep the system in focus with the moving sun. Optical errors on each reflecting surface were implemented in combination with the solar angular cone of ± 4.65 mrad.

As a result, the intercept factor of solar radiation that is available to the receiver was calculated as a function of the transversal and longitudinal angles of incidence. In addition, the intensity distribution on the receiver plane was calculated as a function of the incidence angles.

Figures used in the abstract

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Figure 1 : View of a ray-tracing simulation of the mirror-box system

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Figure 2 : intensity distribution on the receiver surface at longitudinal solar incidence angle 0° , 50,000 rays

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Figure 3 : Visualisation of setup (10 x 15 mirrors) in COMSOL