Numerical Analysis of Pressurized Cavity Air Receiver in Concentrating Solar Power System (CSPCore-2)

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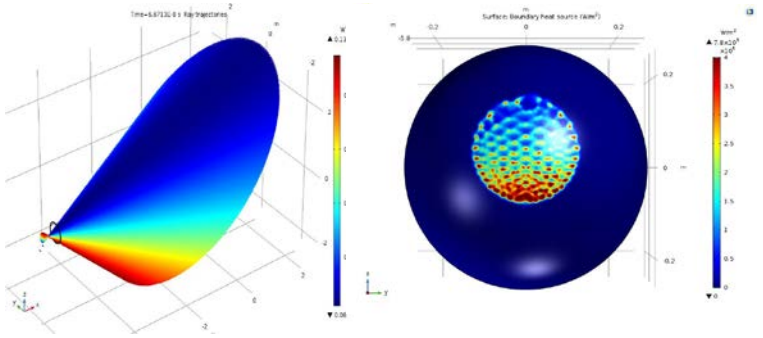
Scientific Achievement:

We carried out a coupled analysis of the cavity air receiver with porous absorber using the finite-element method and completed fabricating the receiver.

Significance and Impact:

Detailed evaluation of the receiver is possible with the present approach because it effectively models optics together with flow and heat transfer. The radiation transport equation is also solved within the porous domain.



Ray-tracing analysis of the receiver.

Research Details:

- Optical modeling of the receiver is implemented in the Ray Optics module of COMSOL 5.3a. Geometric optics interface models the wave propagation and computes ray trajectories for each ray from the source.
- Flow modeling assumes steady-state problem with volume averaging of the porous medium with the Brinkman flow model.
- The local thermal non-equilibrium model along with radiation modeling using P1-approximation is solved to obtain the temperature distribution.
- Optical property of absorption coefficient is assumed to be 220 m^{-1}

Cavity-air-receiver

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