Helmholtz - OCPC - Programme 2017-2021

for the Involvement of Postdocs in Bilateral Collaboration Projects with China

PART A

Title of the project

Thermal performances of Molten Salt Receivers in Solar Tower Power Plants and their dependency on Light and Solar Absorptance Distribution

Helmholtz Centre and institute

Karlsruhe Institute of Technology (KIT) – Steinbuch Centre for Computing (SCC)

Project leader

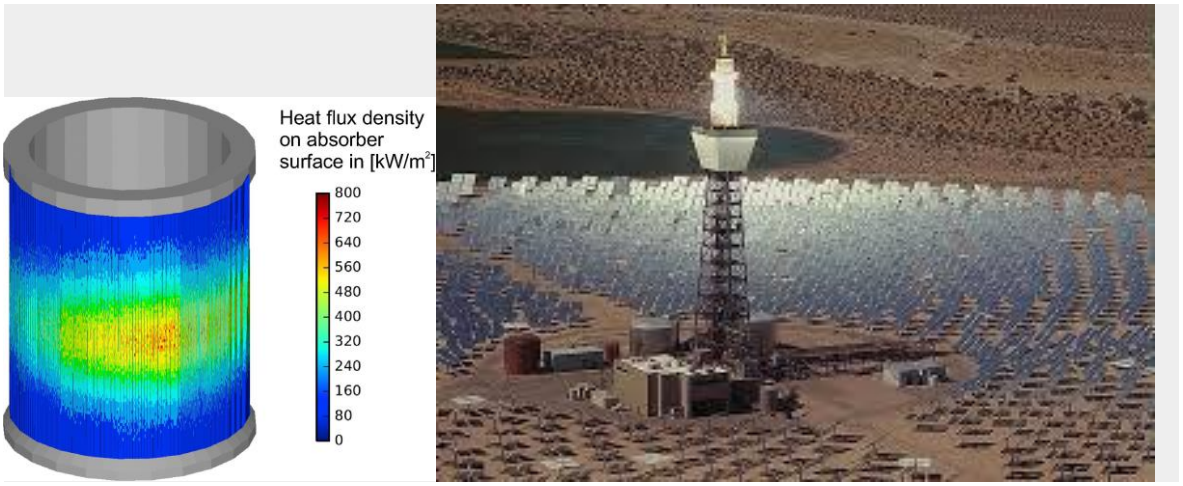
Prof. Dr. Martin Frank

Web-address

http://www.scc.kit.edu/en/research/8037.php

KIT – International Affairs (INTL) Contact: Oliver Kaas Phone: +49 721 608 45323 Email: oliver.kaas@kit.edu

Description of the project:



http://www.prod.sandia.gov/cgi-bin/techlib/access-control.pl/2002/020120.pdf
https://www.researchgate.net

In solar power tower systems, the receiver is a key component. In this work, external tubular receivers are considered, which are of the same type of those adopted in the Solar Two Power Plant (https://en.wikipedia.org/wiki/The_Solar_Project). The high solar flux and thermal gradient on the receiver surface will lead to structural damages, especially because only the front part of tube is heated. For this reason, the heat distribution on the receiver surface needs to be optimised.

There are two possible solutions while dealing with this problem:

- Optimization of the direct and reflected light, to form uniform light distribution (Light Tracing Model)
- Optimization of the solar absorptance distribution on the surface of receiver, to generate uniform heat flux distribution (Thermal Analysis Model)

The light tracing model and the thermal analysis model need to be combined in this project. The tasks to be performed are:

- Literatures review of the light tracing method and solar absorptance properties in receiver systems.
- Development of reflected model and multi-point aiming strategy of light.
- Simulation based on the Monte Carlo Ray Trace and CFD method for a single tube
- Optimization of the absorptance distribution of the coating in the external receiver
- Dynamic model and corresponding control strategy of the heliostat configuration in order to reduce receiver aging and improve its efficiency

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This project is offered by the Steinbuch Centre for Computing and the Computational Science & Mathematical Methods research group headed by Prof. Dr. Martin Frank.

The project will be co-supervised by:

Dr. Daniela Piccioni Koch, daniela.piccioni@kit.edu and Dr. Zecan Tu, zecan.tu@kit.edu

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Description of existing or sought Chinese collaboration partner institute:
Professor Junkui Mao from Nanjing University of Aeronautics and Astronautics and Dr. Zecan Tu, who has arrived at SCC-KIT on 15th October, 2019 in the frame of the HELMHOLTZ and OCPC Programme 2019.

Required qualification of the post-doc:

- PhD in Physics/Computer Science/Engineering
- Experience in modelling Monte Carlo Ray Trace method
- Experience in modelling and simulation with at least one
- of the following software packages: ANSYS Fluent, Comsol Multiphysics, Matlab,
- Programming language: C++, Fortran and/or others
- Additional skills: basic knowledge of German would be appreciated

PART B

Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station in China, which is affiliated to a research institution like a university:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae, copies of degrees
- List of publications
- 2 letters of recommendation
- Proof of command of English language

PART C

Additional requirements to be fulfilled by the post-doc:

- Max. age of 35 years
- PhD degree not older than 5 years
- Very good command of the English language
- Strong ability to work independently and in a team

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