

MONTE-CARLO AND SENSITIVITY TRANSPORT MODEL: APPLICATION IN SOLAR ENERGY

Zili He,^{1,*} Paule Lapeyre,² Stephane Blanco,³ Simon Eibner,¹ Mouna El Hafi,¹ Richard Fournier³

¹ RAPSODEE - UMR CNRS 5302, Campus Jarlard, Albi, 81013, France

² Department of Mechanical and Mechatronics Engineering, University of Waterloo, Canada

³ LAPLACE - UMR CNRS 5213, 118 Route de Narbonne, Toulouse, 31062, France

ABSTRACT. The classical transport model of radiative transfer uses the specific intensity as the descriptor. By differentiating the transport model of intensity with respect to a geometric parameter, a model of geometric sensitivity can be built. In this work, a classical model of intensity and models of geometric sensitivity are built with specular flat mirrors as the boundary conditions and are applied in a concentrated solar power plant. The sensitivities of the impacting power on the receiver with respect to the geometric parameters of each mirror are estimated by the Monte Carlo Method (MCM). Furthermore, by analyzing the sources in the models of geometric sensitivity, the contributions of the typical optical effects: spillage, blocking, and shadowing, to the sensitivity can also be estimated and analyzed, which is essential information to optimize the system.

*Corresponding Zili He: zili.he@mines-albi.fr