

Abstract

In this paper, a mathematical model based on energy analysis, has been developed for modeling and simulation of solar tower power plants (STPP) performances without energy storage. The STPP system has been divided into four main subsystems: the heliostat field subsystem, the cavity receiver subsystem (tower), the steam generation subsystem and the power cycle subsystem (Rankine cycle). Thermal and thermodynamic models of main subsystems have been developed. A general nonlinear mathematical model of the studied system (STPP) has been presented and solved using numerical optimization methods. The obtained results are presented and analyzed. The effects of the receiver surface temperature and the receiver surface area on the cavity receiver efficiency and the steam mass flow have been investigated. The effects of other parameters, such as the incident heat flux, the absorbed energy and the heat losses from the receiver are also studied. The analysis of these results shows the existence of an optimal receiver efficiency value for each steam mass flow, receiver surface temperature and receiver surface area