Abstract

Sameh S Shaaban

Enhancement of the solar trough collector efficiency by optimizing the reflecting mirror profile

The performance of solar trough collectors can be enhanced by optimizing the mirror profile. Accordingly, a method for optimizing the trough mirror profile is introduced in the present work. This method aims at enhancing the amount of reflected solar irradiance onto the receiver tube. Optimum profiles “Opt1” and “Opt2” were obtained by implementing multi-objective multi-dimensional optimization. Results show that the “Opt1” profile enhances the overall efficiency of the trough collector by 8.2% compared to an original parabolic trough collector (PTC). This performance improvement was also recorded at different trough angles. The trough depth was reduced by up to 89% for the “Opt1” profile. Therefore, analysis of the wind loads was performed for the PTC and the optimized profiles. This analysis shows that the “Opt1” and “Opt2” profiles have higher wind loads compared to the PTC whenever the wind is blowing across the trough backside. The “Opt1” profile and the PTC have the same wind loads at the local solar noon. The “Opt1” profile has lower wind loads compared to “Opt2” and the PTC whenever the wind is facing the trough front side. Accordingly, adding shields on the backside of the trough is recommended for investigation in a future work.