Abstract

A heliostat is a structure whose function is to reflect sunlight to a target receiver. It represents an important element in solar tower power plant (STPP).

Heliostat deformations, due to stochastic wind loads and geometrical properties, can degrade optical pointing accuracy and fatigue the structural components. This paper reports on an analytical and numerical program with a goal to improve understanding of the response to wind loading on heliostats reliability.

To this end, the main heliostat components, such as pedestal, torque tube and frame, have been modeled for different azimuth and elevation angles. The obtained mathematical models have been used as performance functions in order to evaluate the structural reliability of heliostat. Subset simulation method has been considered to assess this reliability. The uncertainties in wind speed, heliostat dimensions (diameter, thickness, section…) and heliostat physical properties (yield stress and Young's modulus), have also been taken into account in this study. The results show that the external loads (wind speed) and geometrical properties, such as pedestal and torque tube diameters and truss member sections, have represented an important effect on the heliostat reliability. Therefore, for small heliostats sited in higher wind speed, it is more reliable to use thin torque tube with large diameters. However, a thick torque tube with small diameters are suitable for heliostat placed in lower wind speed.