

Abstract

The thermal performance of fifteen power conversion systems including only fossil, only solar and hybrid solar-fossil power plants have been investigated in the present thesis. To overcome the hurdle of solar radiation measurements that is of a particular use for assessing the performance of solar thermal power plants, seventeen solar radiation models have been compared to select the most suitable one under Algerian climate. The modeling of each part of the power plants has been described with awareness. For the solar field a detailed modeling that comprises the heat transfer in the receiver tube, optical performance of solar radiation collection and heat losses from the piping has been carried out. In order to develop a mathematical model for the fifteen power plant configurations the gas turbine and the steam turbine have been modeled and results were successively validated with the latest commercial turbines. Various integration of solar parabolic trough technology into the three reference power conversion systems including Brayton cycle, Rankine cycle and combined cycle have been considered. Some of these schemes are originally proposed in the present study and important findings have been obtained.