CFD analysis of a one-pass photovoltaic/thermal air system with and without offset strip fins

The focus on managing PV panel temperature has undergone a remarkable development in the last two decades. Specifically, in countries with moderate weather temperature and high insolation, the problem of keeping the PV cell temperature in an optimal range has been managed by use of PV/T collectors. In this work, a single pass PV/T collector using laminar air flow has been assessed. Two PV/T collector designs are utilised, one with and one without offset strip fins. COMSOL Multiphysics v5.3a has been used for the analysis of the thermal and electrical performances. Two assumptions were implemented in order to reduce the computational time from 95 hours to 7 hours, namely ignoring radiative effects between the fins and the wall channels, and representing thin layers as 2D boundaries, whilst ensuring a high level of conformity (4%),. Monocrystalline silicon PV cells were used with a power temperature coefficient of 0.41%. A validation against work in the literature was made, showing a good consistency. The objective of this work is to verify the performance of the air PV/T collector with offset strip fins compared to an unfinned air PV/T collector. The results reveal that the use of offset strip fins has a noticeable impact on both the electrical and thermal efficiencies of the system. In addition, the maximum combined efficiency (ηC_o) for the finned PV/T system is 84.7% while the unfinned PV/T system is 51.2%.