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| Title | A Three-Dimensional Comprehensive Numerical Investigation of Different Operating Parameters on the Performance of a Photovoltaic Thermal System with Pancake Collector | | |
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| Abstract |  |
| Performance of photovoltaic (PV) module decreases significantly with increasing cell temperature due to its overheating. Photovoltaic thermal (PVT) is an optimized technology that facilitates effective removal and utilization of this excess heat leading to enhanced electrical performance. In this article, a 3D numerical model has been developed and analyzed to investigate the PVT performance with a new pancake-shaped flow channel design. This flow channel is attached directly to the backside of PV module by using thermal paste. The governing equations are solved numerically by using Galerkin’s weighted residual finite-element method (FEM), which has been developed using COMSOL MultiphysicsVR software. The numerical results show that the cell temperature reduces on an average 42 \_C, and the electrical efficiency and output power increase by 2% and 20 W, respectively, for both aluminum and copper channels with an increase in inlet velocity from 0.0009 to 0.05 m/s. On the other hand, overall efficiency of the PVT system drops about 13% in both cases as the inlet temperature increases from 20 \_C to 40 \_C. Cell temperature is found to increase approximately by 5.4 \_C and 9.2 \_C for every 100 W/m2 increase in irradiation level of the PV module with and without cooling system, respectively. Regarding flow channel material, it has been observed that use of either copper or aluminum produces almost similar performance of the PVT module. | |