CFD modeling and performance evaluation of multipass solar air heaters

This article investigates the impacts of ow congurations on the thermal performance of a solar heater system. Recycled aluminum cans (RACs) have been utilized as turbulators with a double pass single duct solar air collector. The CFD software of COMSOL Multiphysics V5.3a is used to model three designs: Cocurrent (model A), countercurrent (model B), and U-shape (model C). The numerical results reveal that the U-shape design oers a greater thermal performance of 5.4% and 6.5%, respectively, compared with the cocurrent and countercurrent ow models. Furthermore, an outdoor experiment is performed based on the numerical modeling of ow congurations. The experimental setup is examined for three congurations of model C, namely, solar air heater (SAH) without RAC model C-I (plain model), SAH with in-line RAC layout (model C-II), and SAH with staggered RAC layout (model C-III). We found the double pass single duct solar air collector (model C) design is in a good agreement with the experimental data, and model C-III has a better thermal eciency of 60.2%, compared to those of model C-II, 53.1%, and model C-I, 49.4%.