

Engineering Analysis with Boundary Elements

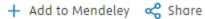


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Numerical simulation of the thermalhydraulic performance of solar collector equipped with vector generators filled with two-phase hybrid nanofluid Cu-TiO₂/ H₂O

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Abstract

In this research, the effect of <u>vortex generators</u> (VGs) with various <u>geometric shapes</u> and Cu-TiO₂/H₂O <u>nanofluid</u> (NF) on thermal-hydraulic (TH) performance, energy efficiency and exergy of a solar collector (SC) has been perused. In this research, the turbulent flow regime (TFR) was used to study the stated parameters. The QUICK algorithm is used for the <u>discretization</u> of the equations. According to the assumption of a TFR, the flow behavior of Cu-TiO₂/ H₂O NF in the *Re* range of 4000–16,000 was studied. In addition, the k- ω <u>SST</u> model was utilized to modelling the turbulent flow. Also, due to considering the NF as two-phase, the Eulerian two-phase method was used for modeling. Two-phase hybrid NFs with Cu and TiO₂ <u>nanoparticles</u> in solid volume fractions of SVF=1, 3, and 5% were modeled. The findings of the research illustrate that <u>convective heat transfer</u> (CHT), Nu_{avg} (average Nusselt number), and pressure drop (PD) increase with the increase of the <u>inlet velocity</u> of Cu-TiO₂/ H₂O NF flow. In addition, the results of PEC evaluation indicate that the adding VGs and changing their placement states is desirable in terms of PEC. In the SC along with the case D turbolator and SVF= 5 %, the <u>exergy efficiency</u> increases by 45.87 % with the increase of the <u>Reynolds number</u> (*Re*) from 4000 to 16,000.