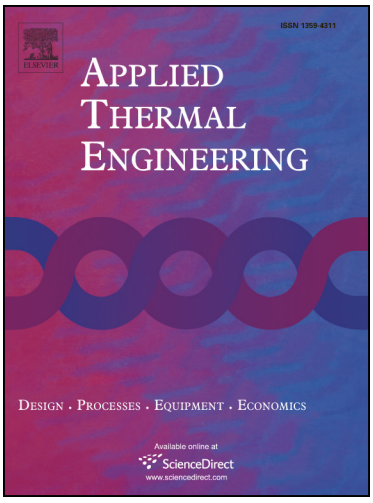

Research Paper

Numerical investigation and experimental verification of performance enhancement of flat plate solar collector using nanofluids

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Numerical investigation and experimental verification of Performance Enhancement of Flat Plate Solar Collector Using Nanofluids

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Abstract

In the present study, the performance of a flat plat solar collector (FPSC) with different types of working fluid; double distilled water (DDW) and Alumina nanofluids with six different volume fractions in the range 0.1%-3% (FPSC) are examined. Experimental and numerical investigations of the collector performance are presented. According to ASHRAE Standard 86-93, outdoor experiments have been conducted under the hot climate conditions in Egypt to test the performance of the FPSC. The experimental results indicated that using Alumina nanofluid improves the collector thermal efficiency compared to DDW by about 3 and 18 % at low and high temperature differences. The study strives to develop a verified numerical model that can test the performance of FPSC using DDW or any nanofluids of any mass fraction as a working fluid. The numerical model is developed using ANSYS 17 software to assess the overall performance of the FPSC. The developed model is well verified by the experimental results. The numerical results showed that (i) increasing the percentage of the Alumina nanofluid improves the thermal efficiency of the FPCS until 0.5% volume fraction, and any further increase has a negative effect on the thermal performance and (ii) the pressure drop increases with increasing the nanofluid fraction.

Keywords

Flat plate solar collector (FPSC); ANSYS model; solar water heaters performance; Alumina nanofluid.