Abstract

The heat dissipation from electronic devices, transformers, IC engine etc., is one of the most critical challenges facing modern industries. High temperature causes a problem in devices and sometimes cause damage. Thus, it is favourable keeping these devices at a limited temperature and take care to cool it to enhance devices work life. The heat sink is one of the common ways to cool electronic components and remove heat generation.

This research uses pinned flat plate heat sinks with SiO_2-water nanofluids to enhance the hydrothermal performance and entropy generation of heat sinks. The computational investigation and simulation of pinned flat plate heat sinks are performed by using ANSYS-Fluent V.14.5. The equations of conjugate heat transfer and laminar convective fluid flow are solved using the finite volume method with a SIMPLE technique. The Pinned Plate – Fin heat sinks include three different pin cross sections; circular (PCP), square (PSP), and elliptic (PEP) as well as flat fins heat sinks as a traditional Case. SiO_2-water nanofluids as base fluid with various nanoparticle volume fraction of 0, 1, 2, 3, 4 and 5% and nanoparticles diameters 20nm have been examined for Reynolds number range between 100-1000. The number of pins (1, 2 and 3) is considered with different locations as well as different pins diameters (1, 2 and 3mm) at constant base wall heat flux at 10^5 W/m^2.

The main data display that the highest average Nusselt number is for PCP around 93% and 100% for pure water and 5% for SiO_2-water, respectively compared with plate fins heat sink. The PCP and PSP have the lowest base temperature, nearly 25% for pure water and 5% nanofluids. Furthermore, the highest hydrothermal performance is for PEP at 1.44 and 1.52 for water and SiO_2-water, respectively of *Re* =1000. While, at *Re*=800, the most magnificent hydrothermal performance is for PCP at 1.44 and 1.50 for water and SiO2-water, respectively. Three pins with 2mm of pins diameter have the largest hydrothermal performance. Moreover, the PCP and PSP have the smallest total entropy generation, approximately 42% for pure water and 5% SiO2-water among other heat sinks. Thus, it is recommended to use this kind of heat sinks with nanofluids instead of traditional coolant for cooling an electronic system.