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NUMERICAL ANALYSIS OF HYBRID SERVER IMMERSED IN SYNTHETIC DIELECTRIC FLUID

By

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Abstract

In recent years there has been a phenomenal development in cloud computing, networking, virtualization, and storage, which has increased the demand for data centers. With this increase, there is a demand for higher CPU (Central Processing Unit) performance and an increase in the Thermal Design Power (TDP). Maintaining the CPU temperature within the specified parameters for air-cooled servers is a challenge in thermal engineering. One of the components of the Data Centers with the largest energy consumption is the cooling system, which uses over 40% of the energy. In single-phase immersion cooling, electronic components are typically submerged in a thermally conductive dielectric fluid allowing it to conduct heat away from all electrical parts. Therefore, the use of direct contact liquid cooling in data centers with high power dense components has recently been encouraged. In this paper we propose a numerical investigation of effects and improvements when attaching a cold plate to high heat flux components in an immersion cooled environment. Given their extremely low thermal resistance, cold plates have been demonstrated to have higher heat dissipation rates, and it has been noted that they increase CPU/GPU clock rates (frequency/performance). In this study, the coolant used in the cold plate is PG25 (Dynalene Propylene Glycol) and the fluid used in the tank is a commercially available synthetic dielectric fluid EC-100. The model is built in such a way that only the CPU is cooled using natural convection using cold plates and the remaining components are cooled by immersion cooling. A baseline CFD (Computational Fluid Dynamics) model using an air-cooled server (Cisco C220 M3) with optimized heat sinks is compared to the immersion cold server with cold plates attached to the CPU.