Master's Thesis Defense Announcement
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PARAMETRIC MULTI-OBJECTIVE OPTIMIZATION OF COLD PLATE FOR SINGLE-PHASE IMMERSION COOLING

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Abstract

The increasing demand for high performance computing in applications such as Internet of Things, Deep Learning, Big data for crypto-mining, virtual reality, healthcare research on genomic sequencing, cancer treatment etc. has led to the growth of hyperscale datacenters. To meet the cooling energy demands of HPC datacenters efficient cooling technologies must be adopted. Traditional air cooling, direct to chip liquid cooling and immersion are some of those methods. Among all, Liquid cooling is superior compared to various air-cooling methods in terms of energy consumption. Direct on-chip cooling using cold plate technology is one such method used in removing heat from high power electronic components such as CPUs and GPUs in a broader sense. Over the years Thermal Design Power (TDP) is rapidly increasing and will continue to increase in the coming years for not only CPUS and GPUs but also associated electronic components like DRAMs, Platform Control Hub (PCH) and other I/O chipsets on a typical server board. Therefore, unlike hybrid cooling which uses liquid for cold plates and air as the secondary medium of cooling the associated electronics, we foresee using immersion-based fluids to cool the rest of the electronics in the server. The broader focus of this research is to study the effects of adopting immersion cooling, with integrated cold plate for high performance systems. Although there are several other factors involved in the study, the focus of this paper will be optimization of cold plate microchannels for immersion-based fluids in an immersion cooled environment. Since immersion fluids are dielectric and the fluids used in cold plates are conductive, it exposes us to a major risk of leakage into the tank and short circuiting the electronics. Therefore, we propose using the immersed fluid to pump into the cold plate. However, it leads to a suspicion of poor thermal performance and associated pumping power due to the difference in viscosity and other fluid properties. To address the thermal and flow performance, the objective is to optimize the cold plate microchannel fin parameters based on thermal and flow performance by evaluating thermal resistance and pressure drop across the cold plate.