

# ENHANCEMENT OF THE COOLING PERFORMANCE OF MICROCHANNEL HEAT SINKS

Bahram Rajabifar

Dr. Matthew Maschmann, Thesis Supervisor

## ABSTRACT

In this report, four different strategies to enhance the cooling performance of a micro pin fin heat sink are investigated and their effect to improve its cooling efficiency are examined. The employment of nanoparticles and nano encapsulated phase change materials (NEPCM) suspensions, as advanced coolant slurries, are the first and second strategies which are investigated. Cooling systems that are improved by utilization of these advanced coolants (individually or combination of the advanced coolants in a two layer contourflow micro-channel heat sink) are modeled and examined and based on the obtained results, a significant potential to improve the cooling performance of the heatsinks is observed. Introducing tip clearance to the fins of a heatsink is the third considered technique in which a range of tip clearance values are introduced to a heatsink and the cooling performance enhancements are compared. Based on the results of the modeling of the heatsinks with different tip clearances, if the tip clearance value is selected and designed appropriately, it can boost up the cooling efficiency of the system, potentially. One of the main obstacles with CNT forests is the limitations on generating accurate 3D shape structures. In this thesis, a new electron beam irradiation based technique to control the final shape of the CNT arrays is proposed and characterized and the effective parameters such as chamber pressure, irradiation current and etc. are investigated and the most efficient setting to provide the best cutting rate is realized.