

# LIQUID METAL HEAT SINK FOR LAPTOP COMPUTERS

Chengyi Gu

Dr. Matthew Maschmann, Thesis Supervisor

## ABSTRACT

With the rapid miniaturization of the electronic systems, heat generation in the components becomes a major concern for thermal management. The high density of heat generation can be a bottleneck to attain higher performance and reliability of computers. Because conventional cooling methods such as finned heat sink are often incapable of providing adequate cooling for sophisticated electronic systems, new systems like heat pipes or liquid cooling systems are being studied. This work focused on the novel design of a liquid metal and heat sink cooling loop targeted for laptop computer thermal management. The liquid metal was driven by an electromechanical pump, offering no moving parts and quiet operation. To better understand the design process, theoretical analysis for fluid flow and heat transfer performance of liquid metal and heat sink are conducted. Furthermore, in order to demonstrate the feasibility of this new concept, a series of experiments on the fabricated module under different heater powers and pump power are performed. A thermal resistance value of  $0.53\text{ }^{\circ}\text{C}/\text{W}$  was experimentally determined, making the performance similar to competing technologies. Performance was impeded by a low pump efficiency, a known impediment with electromagnetic pumps.