COOLING MICROPROCESSORS USING VAPOR COMPRESSION REFRIGERATION

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ABSTRACT

Maintaining future high performance microprocessor chips within an acceptable operating temperature range (e.g. less than 85ºC), is likely to involve the removal of large quantities of heat (e.g. several hundred Watts), from small areas (e.g. 1- 2 cm^2), necessitating very high heat fluxes. To date, heat dissipation from computer chips has generally been achieved by means of heat sinks and fans; however, alternative, more effective cooling techniques are likely to be needed in the future. Three UK universities are undertaking a 3-year collaborative project to develop a miniature vapor compression refrigeration (VCR) system, suitable for future microprocessor and electronic cooling. The design and testing of a novel porous media based evaporator heat exchanger is being undertaken by Newcastle University. Preliminary results suggest that this device should be capable of achieving the high heat fluxes required. The University of Oxford's Cryogenics Group has developed specialised oil-free compressors for low temperature cooling systems for space applications. Based on this work, a new design of compressor has been developed, which is suitable for use with miniature VCR devices. The performance of such systems is being studied by means of simulation by London South Bank University. Models developed to date include an overall miniature VCR system model, and a detailed model of the compressor. The current paper will focus on the design and construction of the compressor and the compressor model developed. The mathematical modelling approach used will be discussed, and the results from a number of simulations will be reported.