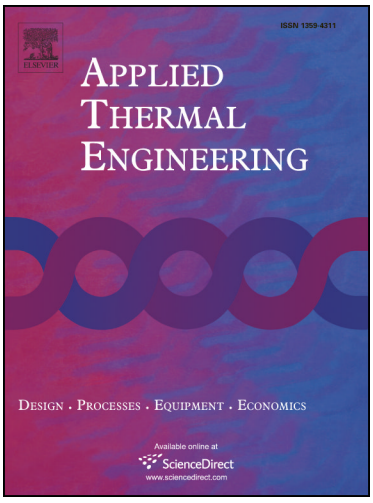

Multi-scale simulation on dynamic performance of an integrated pumping and compression evaporative electronic cooling system

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Multi-scale simulation on dynamic performance of an integrated pumping and compression evaporative electronic cooling system

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Abstract: Two-phase evaporative cooling technology has been widely used for the electronic cooling. In this paper, dynamic performance of an integrated pumping and compression evaporative electronic cooling system was experimentally and theoretically investigated during the system mode variation. A mathematical model was developed based on the ANSYS fluent and validated using experimental data. The results showed a sharp increase in the cooling temperature before the stable cooling condition was achieved as the system operating mode changed to meet the heat load variation. The model was then used to investigate the influence of the different opening and closing order of the valves on the flow rate distributions when the cooling system was switched from liquid-pumping mode to vapour-compression mode. The results showed that the valve sequences had a large influence on the flow distributions during the switching process. This valve sequence substantially influenced the cooling peak temperature when the control time for the whole switching process was longer than 16 s. This analysis indicated that an appropriate valve sequence could reduce the sharp change of cooling temperature and increase the cooling performance during the system switching process.

Keywords: electronic cooling; two phase evaporative cooling; liquid pumping; vapor compression; system control.