

## **Assessment of vortex generator shapes and pin fin perforations for enhancing water-based heat sink performance**

In this study, two models have been analysed numerically to examine the impact of the geometry and the working fluid under laminar flow on heat and flow characteristics. The first model is a perforated pinned heat sink (PPHS) and the second is a new design of a uniform micro-channel having different shapes of vortex generators (VGs) positioned at intervals along the base of the channel. The VG shapes are circular, triangular and rectangular, and are compared to each other based on constant volume. Models with Reynolds number in the range of 50 to 2300 are subjected to a uniform heat flux relevant to microelectronics air and water cooling. Validations against previous micro-channel studies were conducted using the COMSOL Multiphysics® software package and found to be in good agreement. The results show that there is no significant enhancement in heat transfer using water in PPHS. However, the VGs described here are shown to offer significant potential in combatting the challenges of heat transfer in the technological drive toward lower weight/smaller volume electrical and electronic devices. It is also found that the circular VGs offer the best heat performance among the proposed shapes.