### **Abstract**

ACFD study is carried out to enhance the turbulent convection heat transfer of a solid plate-fin micro channel heat sink (MCHS). The goal of this study is to replace the solid fins with porous fins having a constant and variable cross-sectional area with the vertical and axial direction. Convergent and divergent porous fins are also explored. The effect of doubling the size of the porous fins is tested as only the foam is proposed to be above the heat sink substrate without channels. The FVM is adopted for solving the governing equations in 3D. Temperature-dependent properties of water are considered. The results are displayed in terms of the Nusselt number (Nu), wall temperature distribution, pressure drop, friction factor, hydraulicthermal performance (JF), temperature contours, and wall temperature uniformity (TU).The results reveal that the maximum Nuis 21.0 times associated with a friction factor increase of 3.06 times compared to the traditional design. The highest JF is 15.87 for the MCHS-5 when a = 1.0 mm and b = 0.0 mmat Re = 3000. The non-uniform cross-sectional area of the porous fin shows a great thermal performance compared to the standard one. A slight increase in the Nuwith high pressure drop penalty is shown when the porous media volume is doubled.