The Abstract：

The fundamental laws for the effective thermal conductivity of lattice core structures, overlooked in the past, have been derived and exploited for quick estimate of the effective thermal conductivity of complex structures such as octet-truss structure, tetrakaidecahedron structure and various architectures of prismatic cellular metal structures. This attempt was followed by a systematic 3D numerical experiment conducted for forced convection in a series of isothermally heated sandwich panel structures filled with metal foam, rectangular corrugated cellular and various lattice core structures, such as vertical lattices, slanted lattices, Kagome lattices, tetrahedral lattices and pyramidal lattices. The values of the Nusselt number under equal pumping power were evaluated to make a fair heat transfer performance evaluation on these various structures. This evaluation subsequently led to a proposal for a novel lattice core structure. The novel structure exhibited an excellent heat transfer performance due to its enhanced macroscopic thermal dispersion closely associated with the flow pathlines deflection towards the heated end-walls. This study provides numerical evidence to prove that the new structure is a strong candidate for the new generation of compact heat exchanger systems.