Effect of piezoelectric fan mode shape on the heat transfer characteristics

ABSTRACT

Piezoelectric fans with their low noise and power consumption, are an effective means of enhancing heat transfer and is a viable alternative to the natural convection process. Several studies have been extensively carried out at the fundamental resonance mode. In this work, three-dimensional numerical studies on the effect of first, second and third mode shapes driven at frequency and the tip amplitude of the first mode are accomplished to investigate their effects on the heat transfer characteristics. The experimental and numerical model of the first mode shows a reasonably good agreement between them. The results showed that the increase in the mode number decreased the induced air flow velocity on the top of the heated surface, thus impeding the cooling capabilities at higher mode number. The vibrating blade of the first mode produced a pair of asymmetric vortex of opposite circulation around front and the back the piezofan tip, which disappear with the increase of mode number. It is thus established from this work that higher mode of vibrations is ineffective and therefore the fundamental resonance mode is suggested for all practical piezofan applications.

Keyword: Electronic cooling; Piezoelectric fan; Heat transfer enhancement; Vortex; Mode shape