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2007

Local Heat Transfer Coefficients Under Flows Induced by Vibrating Cantilevers

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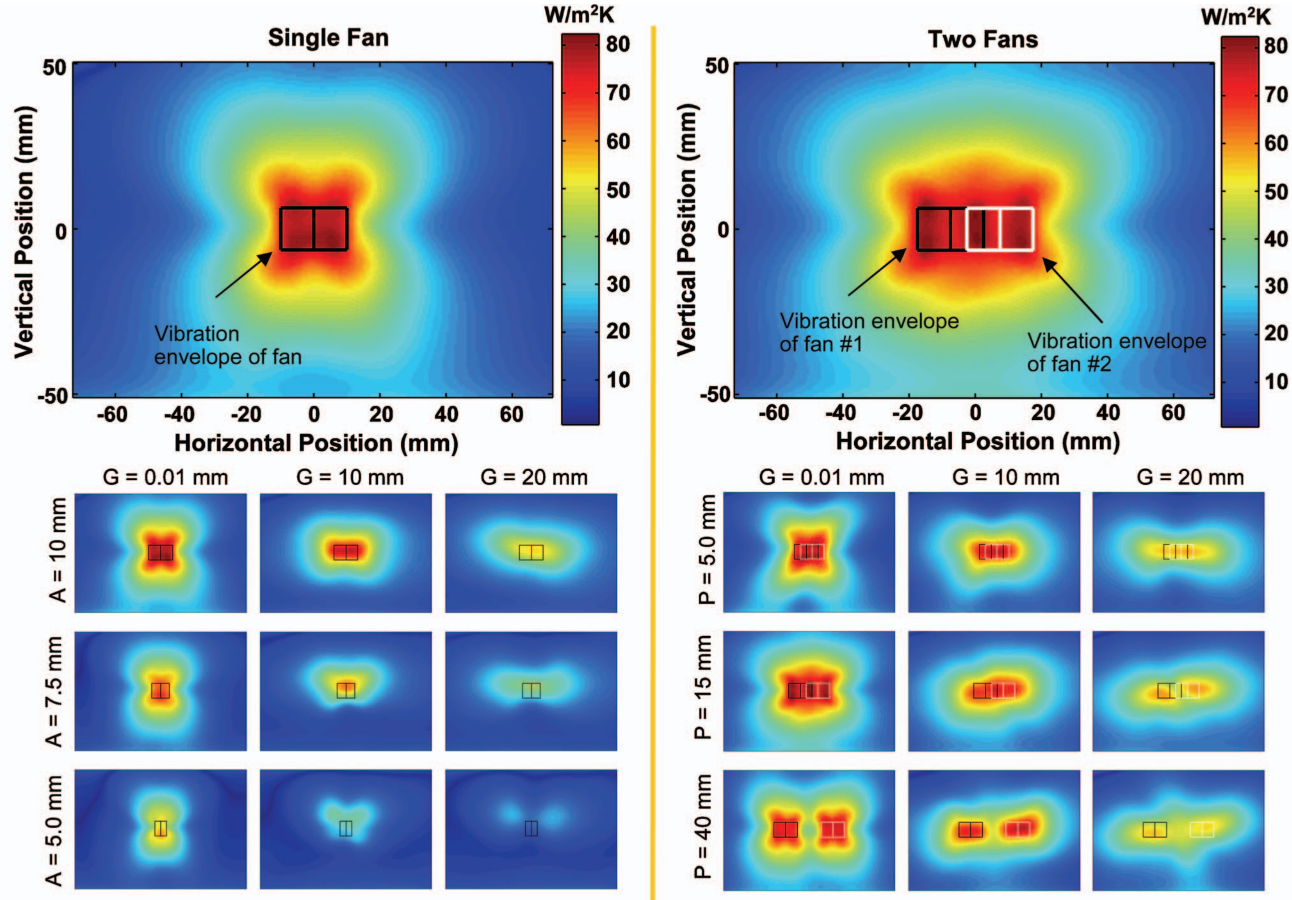
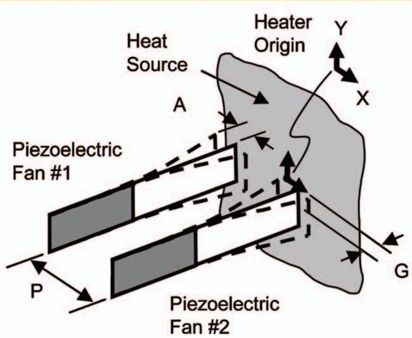
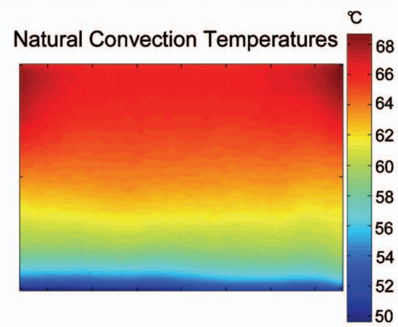




Experimental Setup

Electrically heated stainless steel shim provides constant heat flux surface with horizontal isotherms in natural convection conditions (shown right). Thermal image is captured with IR camera and forced convection coefficient (from motion of fan) is extracted.



Local Heat Transfer Coefficients Under Flows Induced by Vibrating Cantilevers

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Piezoelectric fans are flexible vibrating cantilevers and can provide large enhancements in heat transfer over natural convection while consuming very little power. Flows induced by these devices are visualized experimentally by determining local heat transfer coefficients of fans operating near a constant heat flux surface. Behavior of the temperature contours is dependent on vibration amplitude and distance from heater to fan tip (gap). For small gaps, the cooling is nearly uniform within the vibration envelope. An optimal gap based on the stagnation performance is apparent and appears to be dependent on vibration amplitude. With two fans operating simultaneously, the behavior become more complex, and for an intermediate fan pitch, yields constructive interference where the peak local performance shows an increase of approximately 10%.

