SE&T Colloquium Series-Winter 2019

Speaker	Dr. Monayem Mazumder Department of Mechanical Engineering
Title	***Enhancement of Gas Pumping and Heat Transfer Using a Two-stage EHD Gas Pump***
Abstract	Previous studies have shown that electric field in the form of corona wind can be used for gas pumping and heat transfer enhancement. In this study, the flow field inside a square channel with a two-stage electrohydrodynamic (EHD) gas pump has been critically examined by experimental measurement and numerical simulations. First, the EHD induced flow of the pump with three grounded electrode configurations: 0.5-inch, 1-inch, and 2-inch wide at top with 0.5-inch wide at bottom of two-stage unit is calculated. Subsequently, the numerical results are compared with the experimental data to validate the computational model. The EHD gas pump with 28 emitting electrodes in each stage is tested for a wide range of operating voltages starting from 20 kV up to 28 kV for further improvement in its performance over a single-stage one. It has been shown that the two-stage EHD gas pump can produce and sustain gas flows with a maximum velocity of 2.8 m/s. Its maximum performance of 36 L/s/W is better than that of conventional cooling fans used in personal computers. These configurations are also numerically investigated for their effectiveness in the enhancement of heat transfer. The influence of electric field on the flow and temperature fields is also examined for a wide range of Reynolds numbers. The Reynolds numbers considered in this study varies in a range between 100 and 2000. The emitting electrodes of the EHD gas pump are flush mounted on the channel walls so that the corona wind produced can directly disturb the boundary layers to create the maximum enhancement. The pumping power required for the heat transfer enhancement is also critically evaluated. The maximum increase in the average Nusselt number is 30%, which is achieved at Reynolds number Re = 200 with an applied voltage of 28 kV. The overall effectiveness of the EHD gas pump in heat transfer enhancement is evaluated by the parameter of thermal hydraulic performance, $(Nu/Nu_0)/(f/f_0)$, which is found to be always greater than unity. These results reveal that EHD gas pump has a great potential for many engineering applications, particularly for applications in thermal management.
Date	Tuesday, April 2
Time	4:10-5:00pm
Place	Pioneer 240
	Refreshments will be served at 4:00pm.