SE&T Colloquium Series-Fall 2019

Speaker	Dr. Monayem Mazumder Department of Mechanical Engineering
Title	***Enhancement of Gas Pumping and Heat Transfer Using a Two-Stage EHD Gas Pump Operated at Uneven Applied Voltages***
Abstract	Earlier studies have shown that electric field in the form of corona wind can be used for gas pumping and heat transfer enhancement. A two-stage electrohydrodynamic (EHD) gas pump inside a square channel is critically examined in this study by experiment and numerical simulations for its potential in the enhancement of gas pumping and heat transfer. The flow is induced by the pump with 28 emitting electrodes in each stage charged at a combination of three different operating voltages (20 kV, 24 kV, and 28 kV) for possible performance improvement. The emitting electrodes are flush mounted on the channel walls so that the corona wind produced can directly disturb the development of momentum and thermal boundary layers to create maximum enhancement in gas pumping and heat transfer. The numerical study, which complements the experimental work, enables vivid flow visualizations inside the channel, providing a great insight into the development of induced flow. The two-stage EHD gas pump, which can produce and sustain air flows with a maximum volume flow rate of 8.5 L/s. The pumping power required for the heat transfer enhancement is also critically evaluated. The enhancement produced by the EHD gas pump is found to be higher than other techniques and with a smaller power penalty. The maximum increase in the average Nusselt number is 70%, which is achieved at Reynolds number Re =100 with an applied voltage of 28/28 (top/bottom) kV. The overall effectiveness of the EHD gas pump in the enhancement is evaluated using the thermal hydraulic parameter, $(Nu/Nu_0)/(f/f_0)$, which is defined as the ratio of heat transfer enhancement over the power penalty. It is found that this parameter is always greater than unity for the EHD pump considered. These results reveal that EHD gas pump has a great potential for applications in thermal management and can be more energy-efficient when operated with uneven applied voltages.
Date	Tuesday, October 1
Time	4:10-5:00pm
Place	Pioneer 240
	Refreshments will be served at 4:00pm.