Dr. Emmanuel Nsofor

Fluid dynamics properties and performance of nanofluids (nanoparticles-in-liquids) *(Emmanuel Nsofor – Engineering)*. Novel high power technologies have been developed that utilize smaller feature sizes and are packed into constrained spaces, thus requiring smaller heat transfer systems. Recently, a new class of heat transfer fluids (HTFs) called nanofluids was discovered. A nanofluid is a solid-liquid mixture produced by dispersing metallic nanoparticles in a liquid to enhance the heat transfer performance. The size of the nanoparticles (usually less than 50 nm) results in enhanced thermal conductivity of the base fluid. These nanofluids have substantially higher thermal conductivities compared to their base fluids and do not match the values predicted from existing theories. Thus, further research is necessary on the theories underlying the HT mechanisms in nanofluids. Understanding nanofluids will have a remarkable impact in many sectors, especially transportation and energy systems; designers will be able to reduce the size of cooling components leading to smaller and lighter thermal systems, lower costs and a cleaner environment. Also, the principles of magnetic nanoparticles in biofluids can be applied in drug delivery or other novel medical treatments.

Our research seeks to develop new reliable cooling and thermal management methods through analytical and experimental investigations. Current focus on nanofluids research is divided into two areas, namely (1) investigations on the properties and performance of nanofluids, and (2) generation of knowledge on the fundamentals of energy transport with nanofluids. Our focus is on the fluid dynamics and the mechanisms of heat transfer in nanofluids for the stationary two-phase fluid and flow in conduits, which is essential for heat exchanger applications. A system has been developed to study forced convection nanofluid dynamics in circular pipe flow. REU students will take part in further design and experimental studies. Experiments will mainly be on the laminar and turbulent forced convection of nanofluid flow in constant temperature and constant heat flux heat exchangers. Measurements will be made via a data acquisition system. They may also work with technicians in the fabrication shop using hand and machine tools for construction. The tools may include, drill presses, arc cutting and welding machines, grinders, soldering equipment, power hand tools, sheet metal tools, and assorted shop tools.