Seth Whiteside: Mechanical & Industrial Engineering
Mentor: Mark Owkes -- Mechanical & Industrial Engineering
Modeling the Effects of Warm Buildings on Fluid Flow in Cities

This research seeks to understand how heat transferred from warm buildings effects the fluid flow in cities. The motivation for this research is to understand how this alteration in flow would affect particle dispersion in cities. The goal for this research is to effectively use computational fluid dynamics to model test cases. With the data obtained, project collaborators will be able to design experiments to validate the outcomes of the simulations done using Star CCM+. Initial results showed that a simplified building with a high thermal conductivity was capable of transferring a substantial amount of heat to the fluid flowing past it. Further analysis remains to be done to quantify the effect of this heat on the fluid flow. The remainder of this research will focus on quantifying the effects of heat transfer as well as exploring and simulating more complex buildings and arrangements.

Mark Young: Chemical & Biological Engineering
Mentor: Joseph Seymour -- Chemical & Biological Engineering
Rheological Characterization of HPMCAS in Various Solvents

The purpose of this study was to rheologically characterize solutions by changing the concentration of hydroxypropyl methylcellulose acetate succinate (HPMCAS) dissolved in a variety of solvents, including acetone, methanol, and an acetone and water mixture. HPMCAS is a synthetic polymer derived from cellulose, it has found high interest in the pharmaceutical industry where it heavily used in the formation of spray-dried dispersion's. The characterization of the rheological properties of these solutions is of interest to better understand how the solvent choice and the polymer concentration impact the spray-dried dispersion. Polymer solutions exhibit critical concentrations of overlap and entanglement that correlate to when the polymer chains in solution begin to overlap with other chains and when polymers chains begin to entangle with other chains in the solution. When polymer chains overlap with each other a network forms in the solution, this leads to an increased viscosity as well as viscoelastic behavior that can be observed and characterized. Steady state flow tests, strain sweeps, and frequency sweeps were performed to observe the rheological properties of these polymer solutions. Overlap and entanglement concentrations were found for solutions with the solvents of Acetone, Methanol and an acetone and water mixture. The viscoelasticity of these solutions was then analyzed at polymer concentrations between and above these critical concentrations.