

# Department of Mechanical Engineering

## Thesis Defense

**Student:** Sean D. Lawler

**Title:** Computational Study of Particle Deposition within a HVAC Heat Exchanger

**Date/Time:** Friday, December 5, 2008 at 10:00 a.m.

**Location:** 300 Main Street, ME Conference Room (A228)

**Committee:** Dr. Jamil A. Khan - Advisor

Dr. Charles G. Feigley (Environmental Health Sciences) - Second Reader

**Graduate Studies Representative:** Dr. Guiren Wang – Mechanical Engineering

### Abstract

The quality of indoor air is directly affected by particles that are brought inside buildings through intake ducts, open windows and doors, and cracks or unsealed areas along exterior surfaces. Low indoor air quality has a significant impact on the health of the occupants living and working within a building, so it is important to understand the transport properties that influence particle motion.

Particles have been found to collect and begin colony growth on the moist surfaces of heat exchangers and drip pans of the air-conditioner system. This particle buildup on the heat exchangers can have a negative impact on cooling efficiency of the heat exchanger, as well as, creating increased pressure drops across the heat exchanger. In addition to those negative mechanical effects, the formation of bacteria and fungi colonies can lead towards a significant decrease in the indoor air quality if the particles are re-circulated through the building.

The present study examines several non-isothermal flow parameters, including four eddy-viscosity turbulence models, which influence supramicron sized particle deposition within a chilled water fin-and-tube heat exchanger of a HVAC system. The mesh generation and numerical simulations were performed using commercial computational fluid dynamics software. The gas side temperature and solid temperature distributions were solved simultaneously using conjugate heat transfer, and the dispersed phase was solved using the Lagrangian model. Deposition was found to be strongly correlated with particle diameter, while turbulence had a weak influence on particles with diameters greater than 10 $\mu$ m.