

**ACTIVE CONTROL OF AIR QUALITY USING SYNTHETIC JET
ACTUATORS**

By

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A Thesis Submitted to the Graduate

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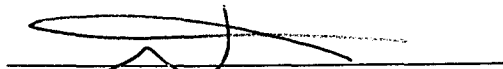
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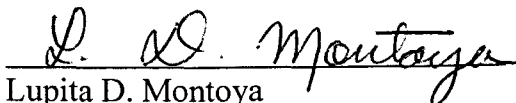
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ABSTRACT

Presently, western people spend up to 90% of their time in indoor environments. This fact presents some unique challenges to the design and implementation of ventilation systems to ensure that people are not exposed to elevated levels of contaminated air. Studies have shown not only the air exchange rates within a room but also the ventilation inlet and outlet locations, design of system and any obstacles to air movement affect the air flow patterns of the room. Furthermore, in the case of particulate contaminants, source location, occupants, and particle size each affect the particle dispersion within a room. Many studies have been done to identify contributing factors to this dispersion; however, there is still a need for targeted control of particulates after release.

Using Particle Image Velocimetry (PIV) and Particle Tracking Velocimetry (PTV), experiments were conducted in a closed chamber to show that synthetic jet actuators are capable of effecting a movement of a particulate plume generated from a point source within the chamber. This technique was tested for two plume release rates (20 and 40 liters per minute), two particle concentration values, normalized jet Stroke lengths (21.0 and 42.4), and different modes of flow control (pull, push, and push-pull).

Results show that the pull and push-pull modes not only contained the plume but also forced the aerosol plume to the lower region of the room where the ventilation system exit was located allowing for its speedy removal from the chamber. Thus, it was determined that synthetic jet actuators were a practical method of directing a particulate contaminant to a collection site. By developing a system that responds differently to differing contaminant release sites, the research presented here can be extended to a system, able to significantly reduce the level of exposure to a particulate contaminant.