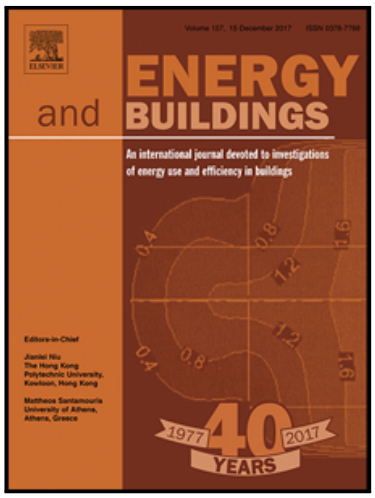


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# A SURVEY OF SEPARATED AIRFLOW PATTERNS AT INLET OF CIRCULAR EXHAUST HOODS

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**Abstract**

In this paper our objectives are to perform a numerical and experimental study of the velocity field in the area affected by a circular exhaust duct, to define the outline of flow separation area at its inlet, to come up with a reliable mathematical simulation of the separated flow at exhaust duct inlet, and to determine the effect of the duct inclination angle its serviced area. The stationary discrete vortex method has enabled development of an adequate and reliable technique for computation of separated flows at inlet of a local exhaust hood. We have studied airflow patterns around the exhaust duct using the discrete vortex method, CFD and natural experiment. Characteristic dimensions of the flow separation area at exhaust hood inlet have been determined with relation to the length and inclination angle of the hood. Shaping the exhaust duct to fit the resulting separation zone outline will enable savings of energy that would otherwise be wasted on overcoming local drag forces; furthermore, this will prevent escape of contaminants circulating in the separation area to the environment. Determining airflow velocity distribution patterns will facilitate the choice of the most efficient exhaust duct design to minimize the cost of contaminant removal.

Keywords: Local ventilation, Exhaust hood, Velocity distribution, Flow characteristics, Capturing hood, Detached flow, Discrete Vortices Method

## 1. Introduction

Local exhaust ventilation is the most efficient means of contaminant removal in various industries with a wide range of personnel activities and workplaces including ore mining [1], metallurgy [2,3], chemical industries [4], capturing hot-air flows [2,5,6], welding fumes [7], dust [8,9,10], vapors, gases, aerosols [4,11,12], releases of waste containing transuranic elements [13] and cooking fumes [14], capturing potentially hazardous contaminants such as anthrax spores at post offices [15], and a variety of other applications. The local exhaust device is the main component of the local exhaust ventilation system. Correct calculation and design of local exhaust ventilation systems would provide a valuable input to the overall design of mechanical ventilation systems in public-use and industrial buildings, additionally contributing to the improvement of indoor environment