MECHATRONICS BOOK SERIES SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 1

Editors
Asan G. A. Muthalif
Amir Akramin Shafie
Siti Fauziah Toha
Iskandar Al-Thani Mahmood

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CHAPTER 5

Mathematical Modeling of Counter Flow Scrubber using Eulerian-Lagrangian Approach

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5.1. Introduction

Spray tower is a circular or rectangular wet scrubber system that uses *preformed spray* in which the particles are collected on liquid droplets within the scrubbing unit. Most spray scrubber systems uses *counter-flow* or two-phase flow geometries in which the liquid (droplets) are sprayed uniformly from the top of the scrubber and falls by gravity, while the gas enters from the bottom of the scrubber and flows upward, [6,9,10]. As shown in Fig. 5.1 below, the spray tower scrubber in this work is a hollow cylindrical body having a height (h=z), radius (r) and line of symmetry.

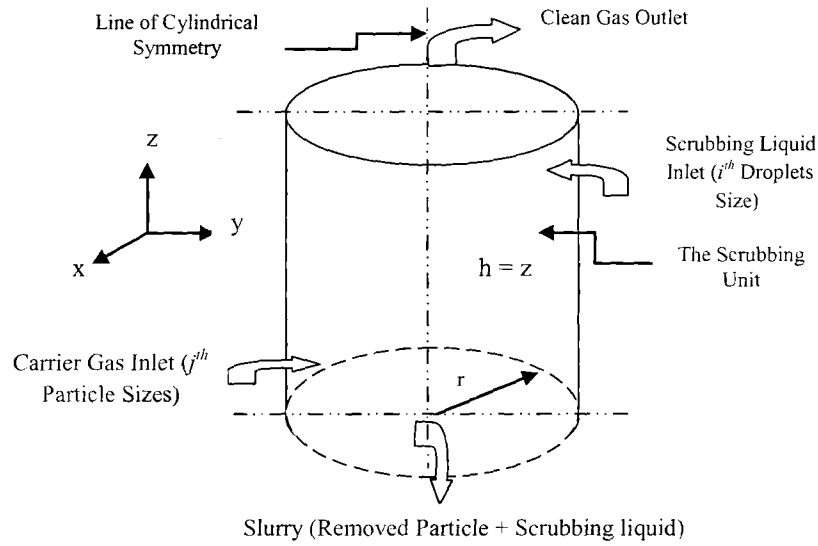

Figure 5.1: Scrubber Counter Flow Geometry

There exists a wide range of complexities in this system, this is due to the influence of the multiphase flow on the scrubber performance, coupled with complex physical processes involved and hence, there is need for the development of a mathematical model that will describe the dynamic behavior of the system.

The objective of this study is to derive a mathematical model of a counter flow spray tower scrubber system based on *Eulerian-Lagrangian* approaches using inertial impaction separation mechanism so as to determine the target droplet or impaction efficiency, particle concentration distribution, particle collection efficiency and penetrations, number of liquid droplets, liquid droplets velocity and liquid spray pattern.