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Numerical simulation of indoor airflow and particle deposition in the clean room (surgical operation room)

Haider M.H. AL-Shami, Ali A. Monem, Emad A. Khazal

Department of Mechanical Engineering, Engineering College, University of Basra, Basra-Iraq.

Abstract
This study presents three-dimensional analysis Lagrangian model (DPM) for particle movement in turbulent indoor airflows inside the clean room (surgical operation room) in al-Najaf hospital in Iraq, to obtain the best appropriate environmental conditions within the room, and to account for the process of particle deposition at solid boundaries. These particles were originated from the supply air. The computations were accomplished with the aid of the computational fluid dynamics (CFD) program, known as ANSYS 15 program using (drift-flux) model. This program was validated against the results of a similar model given by chen. et.al [1], which shows a reasonable matching. The numerical results collected from the surgical operation room were done at different inlet velocities, to state the effect of turbulent inlet airflow velocity on the particles concentration around the room contents (specially the operation table), and to track the paths of these particles.

Keywords: Clean room (surgical operation room); Indoor air-flow; Particles movement; (deposition); Lagrangian method.

1. Introduction

A cleanroom is defined by ISO14644-1 [2] as "a room in which the concentration of airborne particles is controlled., and which is constructed and used in a manner to minimize the introduction, generation, and retention of particles inside the room, and in which other relevant parameters, e.g. temperature, humidity, and pressure, are controlled as necessary [4].
The objective of clean room technology in various clean room classes in the industrial process, operation room and laboratory rooms are to ensure the control of contaminants in sensitive processes. due to exposure of the product to airborne microbes during processing or if severe sedimentation of airborne microbes can occur on critical process surfaces, clean room technology can be used to solve the problems [5, 6]. In an aseptic clean room, the air flow, properly filtered, is flushed from the top of the chamber to special grids placed at the bottom of the structure. Then, it is recirculate by an air filtering unit; here, part of the air flow is ejected and replaced by external air that will undergo filtration. A main requirement of clean rooms is that they are maintained at a pressure higher than the external one, to prevent pollutants air flow from the environment. Currently accepted standards describing clean rooms are developed by ISO (2006) [2].
Chen, F. et, al. [1] developed a three-dimensional drift-flux model for particle movements in turbulent indoor airflows, and combined it into Eulerian approaches to account for the process of particle deposition