Use of COMSOL Multiphysics® for IAQ Monitoring in Cleanrooms

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Abstract

High levels of Indoor Air Quality (IAQ) in Operating Theatres (OT) is an important issue in order to contribute in prevention of Surgical Site Infections (SSI). Despite of specific plant layouts are applied for OT ventilation (e.g. unidirectional flow), the effective use conditions can heavily modify the design microclimate and air quality levels. Medical staff presence and movements and sliding doors opening/closing can cause the compliance or not of some environmental parameters with national and international standards thresholds.

In our work, COMSOL Multiphysics® is exploited for monitoring microclimate and air quality in a real case study (Figure 1). We propose results carried-out by a multi-physical modelling, mainly based on the fluid dynamics solution, and the consequent determination of several transport-diffusion equations for passive scalar variables, such as temperature, relative humidity, carbon dioxide and particles concentration.
A special procedure is proposed to simulate person moving and sliding door opening/closing events. It is mainly based on the definition of specific source terms in the governing equations, assuming assigned values in the portions of the computational domains where the solid objects are located at a chosen time.

Exploiting an iterative cross-comparison of numerical results with available experimental data concerning the studied OT, an innovative methodology is also presented in order to assess the number of particles, for a chosen class of diameter, released by the occupants to the surrounding environment.
From our analyses some IAQ indexes were deduced, allowing to monitor the local and overall OT air quality level supplied by the ventilating system during real operational conditions.

Figures used in the abstract

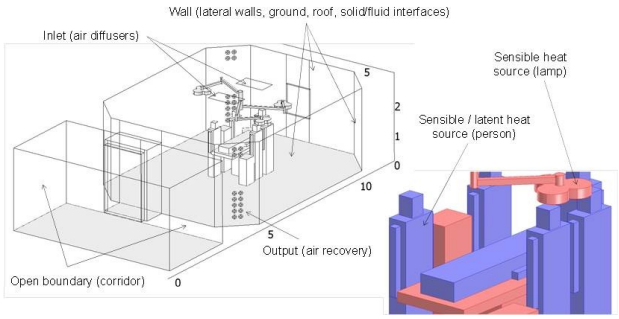

Figure 1: Outline of the studied system.