

CFD MODELLING OF OPERATING THEATER

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The operating theater is the environment inside the hospital that requires the greatest deal of attention in the choice of the devices for air supply, diffusion and recovery. The design of Heating, Ventilation and Air Conditioning (HVAC) systems dedicated to these environment plays a crucial role to drastically reduce the risk of infection for patients, in addition to the maintenance of adequate thermo-hygrometric comfort conditions for the medical team.

The air quality in operating theaters is one of the key factors for reducing post-operative infections rate of surgical procedures. It has been reported that 80-90% of bacterial contamination observed in an open wound comes from the ambient air [1]. Therefore, a lower risk of sepsis has been reported thanks to a cleaner air injection in operating theaters. Several guidelines are available for a correct design of HVAC (Heating, Ventilation and Air Conditioning) systems for operating theaters, depending on the country legislation. For example, the Italian standards are provided by INAIL (previously ISPESL) guideline [2], which define the security and hygiene environmental standards for operating theaters, whereas in USA there is the ANSI/ASHRAE/ASHE Standard 170-2013 [3], which defines ventilation systems design requirements in order to provide environmental control for comfort and asepsis in healthcare system.

The objective of this work is to develop a numerical model able to reproduce the fluid dynamics phenomena occurring in actual operating rooms and compare these results with experimental data. In fact, the authors have also carried out on field measurements by means of PIV (Particle Image Velocimetry) technique for velocity imaging. The experimental data have been used to validate the numerical model developed.

REFERENCES

- [1] Nelson J.P., The operating room environment and its influence on deep wound infection in the hip, *Proceedings of the 5th Scientific Meetings of Hip Society*. C.V. Mosby, St. Louis, 1977.
- [2] ISPESL Department of Occupational Hygiene, Guidelines for the Definition of Safety Standards and Environmental Health Departments Operators (In Italian), 2009.
- [3] Standard 170-2013, Ventilation of health care facilities, ANSI/ASHRAE/ASHE, Tullie Circle, Atlanta, United State of America, 2013.