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A Digital Twin of an Operating Theater

This study is an example of the possible use of the Reduced Order Model (ROM) in air quality management in an operating theater. We present a steady-state CFD (Computer Fluid Dynamics) simulation with the aim of obtaining, in real-time, the variables of interest associated with any change in the room conditions. This is possible by means of a Digital Twin (DT), obtained by a ROM using a Singular Value Decomposition (SVD) compression algorithm.

The problem of air quality had been addressed in operating theaters, highlighting a link with the development of postoperative infections: it is estimated that 19.6% of all infections come from the operating room [1]. In recent decades, the use of CFD [2, 3], has allowed a better and faster understanding of the impact of differences in airflow injection methods through the possibility of easily carrying out multiple simulations that analyze the airflow field in an operating theater. The drawback of the CFD approach is the time required to run a simulation of a scenario that can be a bottleneck, even with the adoption of High Performance Computing (HPC). Such problem can be faced by using upfront HPC evaluation of many combinations of parameters (temperature, pressure, airflow, RH (Relative Humidity), CFU (Colony Forming Unit), etc.) according to the standards. The results are then compressed by creating a ROM that can then be used to inspect how a new parameter combination impacts the field of the variables of interest.

[1] Pasquarella, C., Agodi, A., Auxilia, F., Lytsy, B., Mura, I., Parneix, P., Popp, W., and Brusaferrero, S., "Air quality in the operating theatre: a perspective," *Aerobiologia*, Vol. 36, No. 1, 2020, pp. 113–117.

[2] Di Santis, C., "Design and optimization of operating theater ventilation and contamination control system through an experimentally validated CFD model," Master's thesis, Politecnico di Milano, 2013.

[3] Balocco, C., Petrone, G., Cammarata, G., Vitali, P., Albertini, R., and Pasquarella, C., "Indoor air quality in a real operating theatre under effective use conditions," *Journal of Biomedical Science and Engineering*, 2014.

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