Coupling approach in building physics.

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Due to growing concerns in energy savings, architects and building engineers need to decrease buildings energy footprint. To achieve this goal, industrials have several tools and, among them, the two most interesting are the "Multizonal Approach" and the "Computational Fluid Dynamics".

The first one permits to obtain results over one year in a few minutes but it suffers from a lack of resolution and a bad precision. Indeed, every room of the building is represented by a node in a network. The results are then calculated on the basis of this network and the temperature inside the room is supposed to be uniform. Thus, this approach is not able to describe thermal gradients inside rooms. This is a problem for numerous configurations such as atria or rooms equipped with a radiant panel or a displacement ventilation.

On the other hand, the second approach gives very precise results but it is impossible to realize long term studies due to numerical resources. Indeed, it takes several hours to obtain results in one configuration but it permits to describe the thermal behaviour in details. It has already proven to be able to deal with several physical phenomena involved in building physics. Unfortunately, these tools are not use widely because of their drawbacks. But, their advantages could be combined with those of the Multizonal Approach thanks to a coupling approach.

The perspectives of this new tool are very interesting. This new approach will be address in details. Especially, this coupling approach has to take into account the three main discontinuities between the two tools [2].

1) Time resolution: the time-scale characteristic of the first approach is generally one hour while it is one second with CFD;

2) Space resolution: meshing approaches are completely different for the two approaches;

3) Numerical and temporal resources: the first approach is very easy to use and gives results within a few seconds while CFD requires experience, material and a lot of time before to give interesting results.

This paper will address these three problematic and, eventually, a two-room example of this technique will be described to assess the interest of this method.

References

[1] M Barbason, G van Moeseke and S Reiter. A validation process for CFD use in building physics – study of the different physical phenomena. In Proceedings of the Seventh International Conference on Indoor Air Quality, Ventilation and Energy Conservation in Buildings, Syracuse, NY, 2010.

[2] Z Zhai, Q Chen, P Haves and J H Klems. On approaches to couple energy simulation and computational fluid dynamics programs. Building and Environment, 37:857–864, 2002.

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