

COMSOL Multiphysics® for Building Energy Simulation (BES) Using BESTEST Criteria

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Abstract

Energy performance is becoming more important in the build environment. With better insulated buildings, the possibility of moisture problems and thermal bridges increases. There for, it is not only important to determine the energy performance of a building, but also whether moisture problems occur. There are several programs in which can be determined whether moisture problems will occur, for example WUFI [1] and COMSOL Multiphysics. WUFI is a 2D transient thermal and hygric simulation program. It is used in WUFI Plus Therm, in which whole building energy simulations can be done. In order to get a 3D transient thermal and hygric simulation, COMSOL Multiphysics is attempted to be used for whole building energy simulations in this research. This is done by expanding the existing COMSOL Multiphysics model of a small windowless box, which was validated in the Annex 58[2], to the BESTEST case 600 model. The model was validated using HAMBBase [3]. Except for the solar radiance, the results produced in COMSOL Multiphysics match the results of HAMBBase very closely. Only in adding windows, some differences occurred. This close match between the results produced by the model in COMSOL Multiphysics and the HAMBBase results show that COMSOL Multiphysics is applicable for the use of 3D whole building energy simulations. The 3D thermal and hygric effects can be simulated accurately using the new COMSOL Multiphysics model. Although promising, the model produced in this study is not complete. Solar radiation needs to be added to the model and validated in order to obtain a full whole building energy simulation.

Reference

[1] www.wufi.com

[2] <http://www.ecbcs.org/annexes/annex58.htm>

[3] <http://archbps1.campus.tue.nl/bpswiki/index.php/Hamlab>

Figures used in the abstract

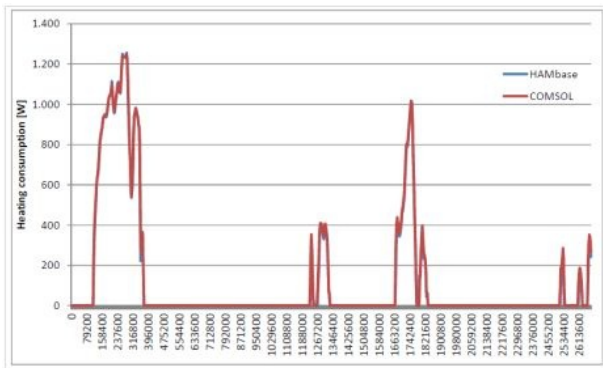


Figure 1: Heating capacity over time as simulated in HAMBase and COMSOL