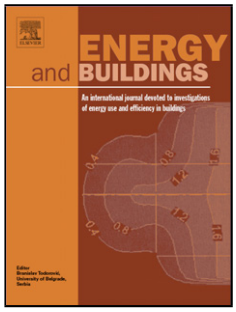

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Adapted time step to the weather fluctuation on a three dimensional thermal transient numerical model with sun patch: application to a low energy cell.

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ABSTRACT

In the case of highly efficient buildings the solar and internal gains have a higher impact on the energy balance than on classical constructions, with lower insulation.

In this context, a model was developed which considers the three dimensional heat transfers through the walls. It simulates the transient behavior of rooms with the use of a refined spatial and temporal discretization and considers the projection of solar radiation through a window onto interior walls, referred to as sun patch. Validation of the model was carried out using experimental data from a low energy cell operating in a natural climate.

Shorter sampling steps seem necessary to consider accurately the fluctuations of the weather data and the short dynamics of the systems such as the regulated heaters. In this paper, simulations with weather data at different time steps (1min, 10min and 1 hour) are going to be analyzed. The impact of the contribution regarding the adaptive and variable time step of the differential equation solver will also be shown. Finally, the impact of the different time steps on the accuracy of the low energy cell's temperatures and heating loads will be discussed.

keywords: weather fluctuation; adaptive integration time step; sun patch; three dimensional envelope model; low energy cell

NOMENCLATURE

Symbols :

λ	thermal conductivity, $W.m^{-1}.K^{-1}$
C	heat capacity, $J.m^{-3}.K^{-1}$
dt	time step, s
S	surfaces matrix, m^2
T	temperature, K
P	heating power, W