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Uncertainty Assessment in Building Energy Performance

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Abstract : The building sector is one of the largest energy consumer with about 40% of the final energy consumption in the European Union. Ensuring building energy performance is of scientific, technological and sociological matter. To assess a building energy performance, the consumption being predicted or estimated during the design stage is compared with the measured consumption when the building is operational. When valuing this performance, many buildings show significant differences between the calculated and measured consumption. In order to assess the performance accurately and ensure the thermal efficiency of the building, it is necessary to evaluate the uncertainties involved not only in measurement but also those induced by the propagation of dynamic and static input data in the model being used. The evaluation of measurement uncertainty is based on both the knowledge about the measurement process and the input quantities which influence the result of measurement. Measurement uncertainty can be evaluated within the framework of conventional statistics presented in the \textit{Guide to the Expression of Measurement Uncertainty (GUM)} as well as by Bayesian Statistical Theory (BST). Another choice is the use of numerical methods like Monte Carlo Simulation (MCS). In this paper, we proposed to evaluate the uncertainty associated to the use of a simplified model for the estimation of the energy consumption of a given building. A detailed review and discussion of these three approaches (GUM, MCS and BST) is given. Therefore, an office building has been monitored and multiple sensors have been mounted on candidate locations to get required data. The monitored zone is composed of six offices and has an overall surface of 102 m^2. Temperature data, electrical and heating consumption, windows opening and occupancy rate are the features for our research work.

Keywords : building energy performance, uncertainty evaluation, GUM, bayesian approach, monte carlo method
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