Geophysical Research Abstracts
Vol. 19, EGU2017-13221, 2017
EGU General Assembly 2017

Study of an experimental methodology for thermal properties diagnostic of building envelop

Yingying Yang (1), Alain Sempy (1,2,3), Tingting Vogt Wu (1,2,3), Alain Sommier (2), Jean Dumoulin (4,5), Jean Christophe Batsale (3,2,1)

(1) Univ. Bordeaux, I2M, UMR 5295, F-33400 Talence, France; (yingying.yang@u-bordeaux.fr), (2) CNRS, I2M, UMR 5295, F-33400 Talence, France, (3) Arts et Metiers ParisTech, I2M, UMR 5295, F-33400 Talence, France, (4) IFSTTAR, COSYS-SII, F-44344, Bouguenais, France, (5) Inria, I4S Team, Campus de Beaulieu, F-35042 Rennes, France

The building envelope plays a critical role in determining levels of comfort and building efficiency. Its real thermal properties characterization is of major interest to be able to diagnose energy efficiency performance of buildings (new construction and retrofitted existing old building). Research and development on a possible methodology for energy diagnostic of the building envelop is a hot topic and necessary trend. Many kinds of sensors and instruments are used for the studies.

The application of infrared (IR) thermography in non-destructive evaluation has been widely employed for qualitative evaluations for building diagnostics; meanwhile, the IR thermography technology also has a large potentiality for the evaluation of the thermal characteristics of the building envelope. Some promising recent research studies have been carried out with such contactless measurement technique. Nevertheless, research efforts are still required for in situ measurements under natural environmental conditions.

In order to develop new solutions for non-intrusive evaluation of local thermal performance, enabling quantitative assessment of thermal properties of buildings and materials, experiments were carried out on a multi-layer pratical scale wall fixed on a caisson placed in a climatic chamber. Six halogen lamps (1.5 kW for each lamp) placed in front of objective wall were used to emulate sunny conditions. The radiative heat flux emitted was monitored and modulated with time according to typical weather data set encountered in France. Both steady state and transient regime heat transfer were studied during these experiments. Contact sensors (thermocouples, heat flux meters, Peltier sensors) and non-contact sensors (thermal IR camera, pyranometer) were used to measure the temperatures and heat flux density evolution. It has to be noticed that the Peltier sensors have been tuned and used with a specific processing to set them compliant for heat flux density measurements.

The measured data from different sensors were analysed and compared. The emissivity of wall surface and treated sensor surfaces were evaluated by using an IR camera with an adapted post-processing. Then, convective and radiative heat fluxes, at wall level, were estimated. Finally, the wall thermal properties can be calculated by using the measured temperatures and estimated heat fluxes using a dedicated thermal quadrupoles heat transfer model and an inverse method.

This study aims at providing some guidelines for the choice of sensors, measurements protocol and adapted inverse model to be tested in real conditions on pilot situ scale.

Aknowledgments : The Authors are very grateful to H2020 Built2Spec project for supporting this work.