In situ measurement of wall thermal resistance by active method

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In an effort to improve the energy efficiency of buildings, thermal performances of opaque walls are currently being verified based on samples tested in the laboratory under a set of very specific conditions. In response to the need for in situ controls to obtain more representative results of real-world responses, a device for measuring the coefficient of thermal transmission of the building envelope is developed through use of an active method based on a thermal excitation coupled with uncertainty estimation.

The extent of thermal insulation used on solid walls remains critical to improving the energy efficiency of buildings. The thermal performance of all insulation introduced must be easily controlled as part of any anticipated building renovation, during construction, upon delivery. The need for an in-situ wall control method is thus more pressing than ever. Such full-scale wall measurements offer an attractive complement to the co-heating method.

The physical parameter representing the quality of a structural shell from a thermal insulation standpoint is thermal resistance. Methods presently exist to measure this parameter, whether in the form of laboratory or exploratory measurements, or as part of international standards or draft standards. None of these methods however actually fulfills the condition of guaranteeing a universal measurement, i.e., one that is: applied to any type of wall or building, conducted any time of year, measured over a short duration, easy to use, available at a modest cost price, and able to limit uncertainty.

An in-situ measurement device gathering these underlying specifications and based on an active method was developed within the scope of the RESBATI Project. The implementation strategy will consist of determining the thermal resistance of several types of solid walls at various scales:

- Reference methods using a guarded hot plate will serve to characterize this parameter at the material level under laboratory conditions;
- Use of climate-controlled chambers and guarded hot boxes, for which environmental conditions and thermal constraints are perfectly controlled and known, will yield the thermal resistance of building walls at the laboratory scale;
- The research prototype, based on active method;

This paper will present the development of a test method and a measurement device to determine heat loss through a wall installed in an energy room and its use on building.

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