Measurement and Modelling of Air Flow Rate in a Naturally Ventilated Double Skin Façade

Heiselberg, Per; Kalyanova, Olena; Jensen, Rasmus Lund

Published in:
The First International Conference on Building Energy and Environment

Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

T09-43

Measurement and Modelling of Air Flow Rate in a Naturally Ventilated Double Skin Façade

Per Heiselberg*, Olena Kalyanova, Rasmus Lund Jensen

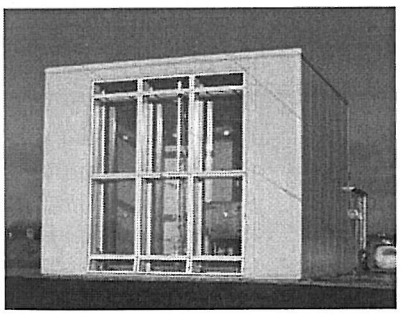
Department of Civil Engineering, Aalborg University, Aalborg, Denmark

*Corresponding email: ph@civil.aau.dk

Keywords: Double skin façade, Natural ventilation, Air flow rate, Full-scale measurements

The use of Double Skin Façades (DSF) has increased during the last decade. There are many reasons for this including e.g. aesthetics, sound insulation, improved indoor environment and energy savings. In a DSF-building a great part of the energy flow happens through the DSF construction and, for that reason, it is extremely important to be able to predict its performance. In a naturally ventilated double skin facade assessment of the air change rate is crucial but extremely difficult to measure because of the stochastic nature of wind and as a consequence the non-uniform and dynamic flow conditions.

This paper describes two different methods to measure the air flow in a naturally ventilated double skin façade. The full-scale experiments were conducted in an experimental test facility with two experimental zones: the double skin façade cavity and the test room behind the DSF. The building has a shape of a cube with the dimensions 6x6x6 m.



Experiments in the naturally ventilated cavity were completed for an external air curtain mode with openings in the external façade at both the bottom and the top. In this mode the air enters the DSF at the bottom of the cavity, heats up when passing through the DSF cavity and then released through the top openings to the external environment, carrying away some amount of the solar heat gains. The flow motion in the cavity is naturally driven.

Measurement results obtained with the velocity profile and the tracer gas method show reasonable agreements. Both methods have sources of error and compared to laboratory conditions have relatively large uncertainties.

Simulations by the thermal simulation program, BSim, based on measured weather boundary conditions are compared to the measured air temperature, temperature gradient and mass flow rate in the DSF cavity. The results show that it is possible to predict the temperature distribution and airflow in the DSF although some discrepancies were found.

This work has been conducted in the framework of IEA SHC Task 34 /ECBCS Annex 43 "Testing and Validation of Building Energy Simulation Tools" and was financial supported by the Danish Technical Research Council, (Grant 2058-03-0100).