



Aalborg Universitet

AALBORG UNIVERSITY  
DENMARK

## 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

[Link to publication from Aalborg University](#)

*Citation for published version (APA):*

Heiselberg, P., Kalyanova, O., & Jensen, R. L. (2008). Measurement and Modelling of Air Flow Rate in a Naturally Ventilated Double Skin Façade. In J. Liu, N. Zhu, & T. Zhang (Eds.), *The First International Conference on Building Energy and Environment: Abstracts* (pp. 263). Tianjin University and Dalian University of Technology.

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

### Take down policy

If you believe that this document breaches copyright please contact us at [vbn@aub.aau.dk](mailto:vbn@aub.aau.dk) providing details, and we will remove access to the work immediately and investigate your claim.

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

Per Heiselberg\*, Olena Kalyanova, Rasmus Lund Jensen

Department of Civil Engineering, Aalborg University, Aalborg, Denmark

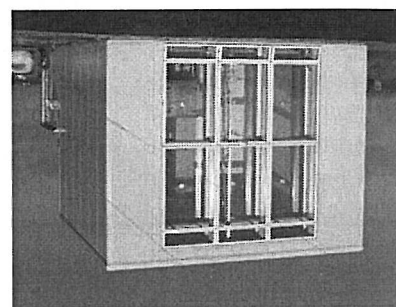
\*Corresponding email: [ph@civil.aau.dk](mailto:ph@civil.aau.dk)

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

The use of Double Skin Facades (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 facade. The full-scale experiments were conducted in an experimental test facility with two experimental zones: the double skin facade 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 facade 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 financially supported by the Danish Technical Research Council, (Grant 2058-03-0100).