

# On the use of hot-sphere anemometers in a highly transient flow in a double-skin façade

Rasmus Lund Jensen, Olena Kalyanova, Carl Erik Hyldgaard

Aalborg University, Department of Civil Engineering

Rasmus Lund Jensen  
Assistant Professor

Department of Civil Engineering

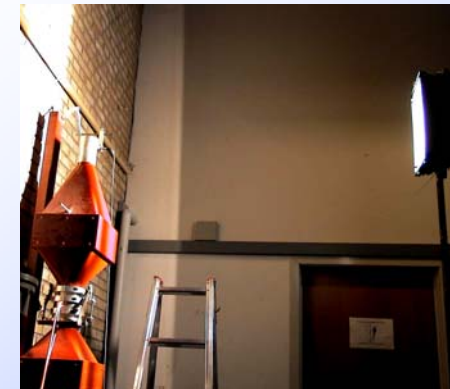
Aalborg University

# "The Cube"

Test facility for investigation of double-skin façade



- Testing the dynamic properties of the hot-sphere anemometers
- Testing the performance of the hot-sphere when exposed to direct solar radiation
- Testing of hot spheres for measurements of the flow direction



## On the use of hot-sphere anemometers in a highly transient flow in a double-skin façade

Rasmus Lund Jensen, Olena Kalyanova and Carl Erik Hyldgaard  
Aalborg University, Denmark

### INTRODUCTION

Hot-sphere anemometers are widely used for measurement of air velocity in the occupied zone. In this paper, the ability of hot-sphere anemometers to measure transient flow in a double-skin façade is investigated. When hot-spheres are used in a double-skin façade (DSF), the conditions are very different from the measurement of air velocity in the occupied zone. The velocity is higher and the flow is more transient, the anemometer is subjected to high loads of direct solar radiation and wide temperature ranges and, finally, the direction of the flow is important.

### 'The Cube'

The Cube, is the new test facility at the Hybrid Ventilation Centre, Aalborg University. The test facility is designed to be flexible for a choice of the DSF operational modes, natural or mechanical flow conditions, different types of shading devices etc. The superior control of the thermal conditions in the room adjacent to the DSF and the opening control allow to investigate the DSF both as a part of complete ventilation system and as a separate element of building construction.



Hot-sphere anemometers placed in the double-skin façade.

### Testing the performance of the hot-sphere when exposed to direct solar radiation

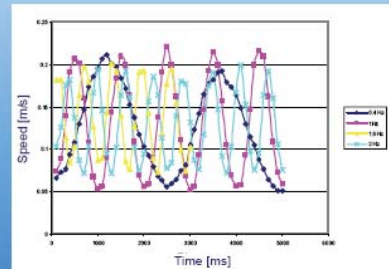
The presence of direct solar radiation is an essential and distinctive element in the DSF operation. A hot-sphere anemometer was located in the jet-wind tunnel, described in the above sections. The effect of solar radiation was imitated by a strong lamp, producing 800 W/m<sup>2</sup>.



Hot-sphere anemometers placed in the jet-wind tunnel.

### Testing the dynamic properties of the hot-sphere anemometers

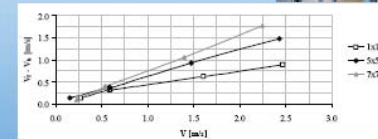
The principle of the test method is to place the anemometer in the laminar air flow generated by a jet-wind tunnel and then oscillate the sensor back and forth in the air flow by means of a crank movement, hereby overlaying the laminar flow with an almost pure sine wave.



Dynamic response of the hot-sphere anemometer measured at 4 different frequencies of deviation.

### Testing of hot spheres for measurements of the flow direction

A simple method to register a flow direction using two hot-sphere anemometers separated by a small plate is tested. With increase of the plate size, the difference between readings from the front and back anemometer becomes much larger.



### CONCLUSIONS

Three different test cases are described in the testing of the hot-sphere anemometers for their further application in the DSF cavity. The obtained results show that the hot-sphere anemometers present a good solution for investigating the air flow in the DSF cavity. It is demonstrated that the hot spheres respond well to the fluctuations, at a frequency up to 1 Hz. Higher fluctuation frequency mainly results in over prediction of the low velocities. Solar radiation does not influence readings from the hot-sphere anemometers, and they can be used for the velocity measurements in the DSF cavity. Finally, it is possible to distinguish the flow direction in the DSF cavity when using hot spheres and the procedure for that is also described.

Rasmus Lund Jensen, rlj@civil.aau.dk, www.civil.aau.dk  
Department of Civil Engineering, Aalborg University, Sohngaardsholmsvej 57, DK-9000 Aalborg, Denmark