

## Pressure Sensing Strip for Rapid Aerodynamic Testing

N. Schmid, M. Fretz, S. Bitterli, T. Burch, L. Neumann, J. Auerswald, H. F. Knapp, S. Graf, C. Bosshard, P. Sollberger\*, F. Zimmermann\*, Z. Stössel\*, T. Harvey\*\*, J. Zhu\*\*, R. Hamza\*

A pressure sensing strip is being developed in order to measure pressure profiles for rapid aerodynamic testing. It combines state of the art pressure sensing technology with integrated micro-fluidic pressure signal guidance in order to produce a non-intrusive pressure distribution measurement device. A patent is pending.

Currently low pressure profiles are primarily measured with pressure transducer arrays: A number of tubes lead from a pressure transducer array to corresponding measuring taps on the surface to be measured<sup>[1]</sup> (Figure 1). Setting up such a system is time consuming and costly and on thin profiles or brittle materials it is not even an option (e.g. sails, glass). Alternatively, non intrusive pressure sensitive paints can be utilized, but there is a lack as far as sensitivity, accuracy and reproducibility is concerned.

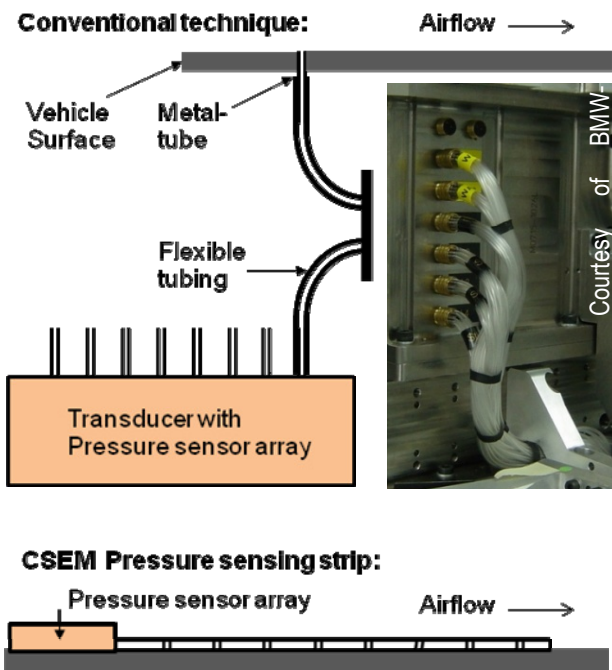


Figure 1: Comparison between conventional and CSEM PS strip

The pressure sensing strip measures pressure profiles non-intrusively without impeding sensitivity. The device can directly and easily be placed onto the surface to be measured (Figure 2). It combines state of the art pressure sensing technology (piezo-resistive sensors) with integrated microfluidic pressure signal guidance (Figure 3). A film with integrated micro-channels guides pressure signals from an arbitrary point on the surface to the sensor, which does not obstruct the fluid flow at the place of measurement..

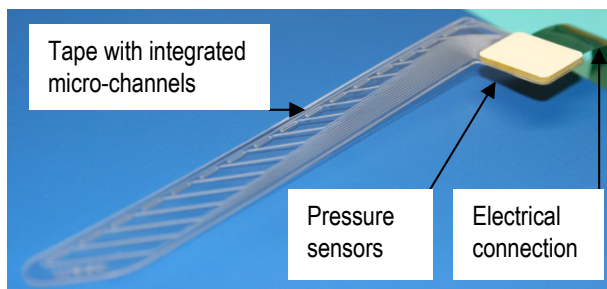


Figure 2: Pressure sensing strip

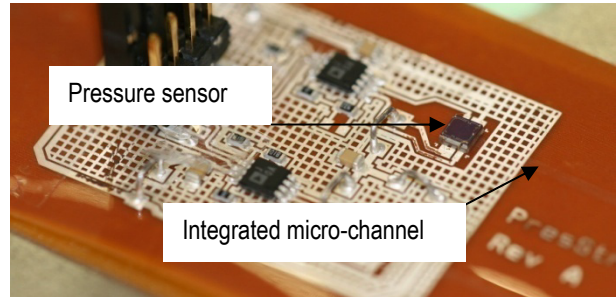


Figure 3: Pressure sensor on flexible PCB manufactured at Epigem

Wire-less data transmission can be utilized in order to further increase system flexibility such as mounting the entire device on a rotating blade (e.g. wind turbine).

Potential markets can particularly be found in R&D testing environments (e.g. wind tunnels) in following industries:

- Automotive
- Aerospace
- Wind turbines
- Urban goods
- Watercrafts
- HVAC

Table 1: Targeted specs

Pressure range	6000	Pa
Pressure accuracy	30	Pa
Pressure resolution	3	Pa
Strip thickness (at measuring points)	< 0.8	mm
Strip length	20 to 500	mm
Temperature range	0 to 60	°C
Measuring speed per sensor	300	Hz

This work was supported by the EU, (project IST-FP6-027540, IntegramPLUS) and the MCCS Micro Center Central Switzerland. CSEM thanks them for their support.

- Hochschule Luzern Technik & Architektur, Horw
- \*\* Epigem Ltd, Redcar
- \* Yole Développement, Lyon
- [1] Race Car Aerodynamics, Joseph Katz