

## MICROSYSTEM FOR SMART REGULATION OF INDOOR CLIMATE

*K. Kohlhof\**, *I. León<sup>+</sup>*, *R. Amador<sup>+</sup>*, *O. Martinez<sup>+</sup>*

\*University of Applied Sciences Cologne, Betzdorfer Strasse 2, 50679 Cologne, Germany

<sup>+</sup>Microelectronics Research Center (CIME), P.O.Box 8016, Havana 10800, Cuba

email: karl.kohlhof@fh-koeln.de

### ABSTRACT

State of the art air-conditioning only regulates room temperature by appropriate switching of the cooling compressor. Air ventilation is not regulated but only set to people's request. Usually that leads to an operation condition with too extreme cooling and too fast ventilation, in any sense out of the limit of thermal comfortability according to the international standard ISO 7730. Furthermore such an extreme cooling requires a high energy consumption for air-conditioning and provokes unhealthy conditions for people, such as colds or even stiff necks.

The main reason for such a misoperation is the lack of detection of all parameters responsible for comfort climate conditions: Beneath air temperature also relative humidity and, most important but mainly neglected, air velocity and derived from it air turbulences have to be recognized if a comfort and healthy climate according to ISO 7730 should be obtained. Whereas sensors for temperature and humidity are on the market a velocity transducer, capable for detection of slow and turbulent air streams in more than one dimension, is not available with such a small size that it fits to installation standards and fulfills minimum design aspects for raised claims such as in hotels.

We present a small sized sensor for the detection of air velocities in two dimensions based on the anemometer principle and fabricated by surface micromachining. That microsensor is also suited for the determination of the degree of turbulence. Combined with temperature and humidity detectors on a single chip a prototype of a microsystem for the detection of indoor climate could be realized.

Based on this micro-climate-sensor an intelligent climate control system has been defined regulating not only the cooling compressor but also the amount of air ventilation. That is done by an expert system choosing the appropriate working conditions only to the demand of the client how he wishes his individual impression of the room climate, ranging from slight cool to slight warm. The system preserves on the one hand side the comfort climate according to the standards and minimizes on the other hand side the amount of energy required for air-conditioning by up to 30%. Principally that is obtained by replacing air cooling by air ventilation within the allowed operation limits.