Detection of damaged sensors in the matrix of amperometric gas sensors

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Air pollution is a growing concern of the civilized world. Recent studies highlight that exposure to polluted air can increase the incidence of diseases and deteriorate the quality of life. Hence, it is necessary to develop tools for real-time air quality monitoring. For air pollution monitoring a wide range of stationary gas and particulate analysers can be used. However, such instruments are relatively large, heavy and expensive. Only governments, local authorities and major industries can afford to use such devices. Instruments based on low-cost gas sensors can be an interesting and promising alternative.

There are many gas sensors working based on different operating principles that can be used in ambient air monitoring. Among commercially available gas sensors, amperometric sensors sims to be the most promising providing relatively high analytical performance at a modest cost [1]. However, real-life usage of gas sensors in monitoring outdoor air is connected with several challenges, such as lack of selectivity or temperature or humidity changes affecting sensor response.

The use of chemical gas sensors in an array format with a pattern recognition system improves the performance of the gas sensing systems based on low-cost sensors. In the sensor array, each sensor has a partial selectivity. A few sensor matrix outputs produce a measured gas fingerprint that can be identified by a pattern recognition algorithm. A sensor array is the base of the instrument known as the electronic nose, which is inspired by the mechanisms involved in human olfaction.

In an array of gas sensors constantly working over a long time one or more sensors can fail. Sensors may suffer from failure, degradation, external interferences, bias drift or noise [2]. Although these problems can be overcome by technology improvements and careful system design. Electronic nose response usually contains redundant importation that can be useful in the identification of the sensor failures. In this study, an approach of using computational methods of signal processing in order to detect and compensate the output signal of the affected sensor or sensors is proposed.

The detection of a faulty sensor is already discussed in the literature [3, 4]. Most of the presented results are related to the semiconducting gas sensors. Furthermore, most of them do not take into account the specifics of electronic nose systems working in real-life conditions. In this work, we compare few techniques used to detect, identify and correct faulty sensors affected by a simulated sensor few most common faults that can occur in sensors operating in real conditions along the time.

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