Journal of Analytical Methods in Chemistry

Special Issue on
Signal Processing in Analytical Chemistry

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Signal processing is one of the most powerful technologies shaping scientific and technical development in the twenty first century. Sophisticated math and software are becoming key tools in a wide range of systems and applications, from scientific research and specialized medical and advanced industrial applications to low-cost consumer electronics. Due to a combination of different fields of knowledge, signal processing has developed into an individual methodology that retains its distinctive features and principles in spite of a wide variety of its approaches and algorithms that can be applied in an extremely wide range of practical situations.

Signal processing is an integral part of the modern analytical system that plays a critical role in ensuring the quality of measurements. In analytical chemistry, it is used in both qualitative and quantitative analysis to study physical and chemical properties of various materials and processes involving complex mixtures of compounds. The purpose of signal processing is to transform an analytical response in order to make it optimal for a specific analytical purpose by increasing its information content and specificity, making further modeling less complicated, thus providing prerequisites for an improved prediction. The discipline of signal processing covers a wide variety of data processing methods that can therefore be efficient in extracting information of different nature in diverse practical situations. The processed data and its analytical space can be one-dimensional (e.g., for chemical analyses), two-dimensional (e.g., for images), or multidimensional in the case of complex modern systems and experiments.

The digital revolution enriched signal processing with a plenty of new tools capable of solving modern analytical problems of growing complexity. Over the years, the progress in analytical measuring systems was conditioned by advances in electronics, sensing principles, and the application of new materials and microfabrication capabilities, as well as modernized data acquisition techniques. An intelligent signal processing algorithm can be the central aspect of any optimized measurement procedure. It can essentially expand the applicability, improve the efficiency, and maximize the performance of an analytical system.

Potential topics include but are not limited to the following:

- Sampling and quantization of analytical signals
- Signal normalization and standardization
- Interfering signal components removal, that is, elimination of contaminants, substrate signals, sample matrix constituents, and so on
- Baseline correction
- Separation of the overlapping useful components
- Domain transformation by FT or WT
- Detection of the important features of the signals
- Differentiation and integration
- Compression of signals and images
- Novel chemometric approaches in multivariate signal processing
- Influence of the adequate and optimized signal processing for the analytical parameters
- Evaluation of the signal processing effects
- Software for signal processing

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