Title: Higher Order Spectral Estimation and Its Application for Biomedical Signal Processing.

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Abstract:

Digital signal processing is one of the most powerful technologies that will shape science and engineering in this century. Most techniques used in signal processing are based on second-order properties estimation, for example, the power spectrum and autocorrelation function. However, second-order properties estimation has limitations on what information can be extracted from the signal. To overcome some of these limitations researchers from different fields are now using Higher Order Spectra (HOS).

Biomedical signals are complex signals and often appear random when in fact they are deterministic and non-linear. Many biomedical signals are non-minimum phase and the phase information in a signal is often the most important information. Another important problem is the detection of non-linearities such as phase coupling between harmonically related sinusoidal components. The biomedical signals are subject to measurement from noise that is usually well modelled as being Gaussian. As Gaussian noise contains no higher order spectral information, it is effectively eliminated by the use of HOS techniques.

The technique of HOS analysis is a powerful tool for biomedical signal processing with potential applications in assessment of ECG (electrocardiogram), EEG (electroencephalogram), EMG (electromyogram), fetal heart rate monitoring, etc. In this paper, we will present some properties and the estimation of HOS, how it is useful to overcome the limitations of second-order properties estimation with examples of its potential for application to clinical problems.

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