

INSTANTANEOUS NUMERICAL SPECTRAL ANALYSIS OF THE SIGNALS

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Any spectral analysis needs a signal with certain time length or endurance. The numerical analysis needs the numerical function of the signal as an array of the discrete values at discrete moments. The numerical spectral analysis of the signal uses the numerical integration of the numerical function for each frequency from the spectrum and these demands a certain time, dependent from the signal endurance, density of the function numerical values and number of the discrete frequencies in spectrum. This time can be reduced drastically with adequate algorithms, presented in the work, and the analysis can be made practically instantaneous. The concepts “instantaneous” or “simultaneous” refer not more to events in very short time, at limit $dt \rightarrow 0$ but in a finite time $\delta t = \text{finite}$. In numerical analysis more events are simultaneous if these run at different moments but the time difference is shorter as δt .

The spectral analysis is made with the Fourier transform $F(j\omega)$ defined for the continuous signals functions [1], [5] with an integral, but numerical the integral becomes a sum from all information contained in all samples from the “chunk”. In order to reduce the needed time for calculus the sum is not necessary to be calculate. Because the spectral analysis is made continuous on successive “time chunks” which contain a certain number of signal samples and the succession run step by step after each time increment δt , the sum at each step needs only the elimination of the information contained in the lost sample and the addition of the next information from the new entered sample.

Specialized digital measurement equipments or an all-purpose calculator can make instantaneous analysis of the signal if the sample rate offers enough time increment δt in order to calculate all values of the spectral function. The proposed formulas offer the shortest calculation time and, together with high-speed microprocessors bring the possibility of an instantaneous analysis of signals with increasingly frequency.

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