NEW METHODS FOR PULSED RADAR AND IONOSONDES: ITERATIVE PRECISION SPECTRUM ANALYSIS AND TWO COHERENT FREQUENCIES FROM SINGLE PULSE

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Using standard spectrum analysis (e.g.: FFT), a simple process determines the exact frequency, amplitude, and phase of the largest spectral line. In the time domain, the accurate sine and cosine functions are subtracted from the data, but stored when the information is useful. By these means not only the spectral line is removed from the spectrum, but also its unwanted wings. This process can be repeated as often as necessary until a sufficient signal-to-noise ratio is established and a sufficient number of wanted signals are detected or interferers are eliminated. Applications are unlimited: precise determination of specific frequencies, including amplitude and phase, in a spectrum; elimination of large interferers in broadband communications; and increase of the dynamic range in special codes and non-linear spectrum analysis.

Even in sophisticated Spectrum Analyzer equipment, processing time for very long spectra significantly limit spectral resolution. But the presented method (which has been patented) can improve the resolution for the larger spectral lines substantially. Thus the amplitudes and phases of harmonics could be measured accurately in respect to the basic frequencies.

Coherent Radars are often affected by narrow-band interference that can be 40 dB above the pulse signal. All the intra-pulse and pulse sequence coding does not help in those cases. Iterative Precision Spectrum Analysis eliminates many spectral lines in real time. In mono-static pulse sounding, measurement of long-range echoes with large Doppler frequencies is often coded pulse sequences cannot be used for pulse compression to reduce noise. Although needed. If, in addition, echoes from short ranges could occur simultaneously, standard phase the method of unevenly spaced pulses, called the Staggered Pulse Code, is a known alternative, it has not been used much because of its limited dynamic range of amplitudes. These limitations are overcome by the proposed method.

For single and sequentially coded pulses, simple half-sine modulation can be used to extract two coherent frequencies for accurate range measurements. In ionosondes this shortens the sounding time by one half.

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2. G - Ionospheric Radio and Propagation

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