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Compensation Function for Enhanced Bandwidth and Improved SNR through Programmable Spectral Shape Signals

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Abstract : Plant physiological parameters are of great importance for different applications, and a conventionally invasive or expensive approach is adopted. Using an air-coupled resonant ultrasound application, a portable, cheap and real-time non-invasive approach is proposed here. The most important is SNR and bandwidth for this application; however, due to attenuation in air, varying temperature, humidity, pressure, electronics noise, large acoustic impedance mismatch, and narrow bandwidth of transducer influence the leaf parameters for characterization. The solution proposed is based on arbitrary position and width pulse sets instead of simple pulse excitation signals. The programmable spectral shape can be obtained for spread spectrum signals. The bandwidth with acceptable SNR describes the attainable resolution for measurement range. The broader the bandwidth, the broader the range of the measured leaf. The novelty of this approach is not only signal but real varying noise-based SNR compensation function. To further simplify the electronics, unipolar excitation signals are used. The compensation function is developed using programmable spectral shape-based excitation signals. This resulted in increased bandwidth, improved SNR and decreased bias errors. Results show significant improvement in the bandwidth from an initial 850 kHz to 1000 kHz. Moreover, bias errors are reduced significantly.

Keywords : resonance spectroscopy, spectral losses compensation, signal-to-noise ratio, spread spectrum signals, ultrasound.
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