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A new ultrasonic exponential decay pulser technique for low concentrations detection and measurements

Abstract

The objective of this study was to design and implement a new ultrasonic pulser with adjustable concentration detection. The new technique based on transmits a multiple ultrasound pulses with decay power through slurry to determine the lowest concentration that can provide an accurate attenuation measurement and wide measurement range. The ultrasonic pulser was designed to transmit a reliable pulsed-power decay set that can be reprogrammed with new output variables, e.g., the pulse amplitude, the pulse frequency, the set size, the decay power factor of the pulse amplitude, the transmit mode, and the time interval. Ultrasound attenuation measurements were obtain for kaolin-water slurries with1%, 10%, 20%, 30%, and 40% kaolin concentration by weight. Concentration attenuation measurements of less than 5% may prove useful for process control when detecting contaminants. A long measurement level is obtained from the pulsed-power transmission, regardless of the material used to construct the container. A signal in the receiver transducer provides the attenuation measurements, for each echo, a fast Fourier transform (FFT) of the appropriate signal was obtained and compared with the water signals to yield the attenuation (asa function of frequency). The data show the feasibility of measuring a kaolin concentration of less than 5 wt%. When using a commercial pulser with the same device setting, no detectable echo was observed. Therefore, new technique measurement may prove useful in detecting solid content in liquid. This study demonstrated that the proposed pulsed-power transmission technique is promising for evaluating low concentrations of solids in fluids and for measuring sedimentation in solid-liquid systems.

Keywords

Attenuation; Contaminates detection; Process control; Pulse-power decay system