**Passive Measurement of Remaining Wall Thickness Using Acoustic Emission Excitation**

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ABSTRACT

Erosion-Corrosion is a combined mechanical-chemical process that occurs when particles suspended in a fluid flow abrades the inside surface of a pipeline. It is particularly problematic for the oil industry as the damage mechanism can occur rapidly and is difficult to predict. To mitigate this acoustic emission transducers are installed to detect the presence of particles impacting the inside surface of the pipeline; when the acoustic emission reaches an unacceptable level the fluid flow is reduced or stopped. While the acoustic emission transducers detect the presence of the particles that are a prerequisite for erosion-corrosion, they do not directly monitor corrosion. It would therefore be an attractive proposition to use the existing extensive network of acoustic emission transducers to also monitor wall thickness. The challenge is that acoustic emission monitoring systems are passive; they are not equipped with excitation capability. It is well-known that valuable ultrasonic information can be derived from autocorrelating acoustical noise. Specifically, the autocorrelation function of a diffuse acoustic field is equal to the Green’s function of the body. Consequently, a band-pass filtered autocorrelation function of an acoustical noise measurement will be approximately equal to an active pulse-echo measurement of the same bandwidth. The present study will show that measurements of wall thickness can be achieved by autocorrelating passive acoustic emission signals.

Two measurement modalities will be presented: a) time-of-flight measurements and b) resonant ultrasound spectroscopy measurements. The more usual time-of-flight based measurement is limited by the fact that acoustic emission transducers typically have sensitive bandwidths limited to <1 MHz. The relatively low frequency limits the use to thick wall components where the component thickness >> ultrasonic wavelength. In thinner walled components a resonant ultrasound spectroscopy approach is required. An acoustic emission transducer is well-suited to these measurements due to the wide bandwidth. Experimental measurements will be shown that are truly passive (with no purposeful excitation at all), and semi-passive, utilizing sand impact or compressed air as the excitation mechanism. Results show very good agreement to active measurements.