

ULTRASONIC WAVEGUIDE SENSORS FOR MEASUREMENTS IN PROCESS INDUSTRIES

**Nishanth Raja¹, KRISHNAN BALASUBRAMANIAN², Parveen Nisha³, NIDHINA
DAS⁴**

¹CENTER FOR NDE, XYMA ANALYTICS PRIVATE LIMITED, India, ¹Department of mechanical engineering, Indian Institute of Technology -Madras, India, ¹DEPARTMENT OF MECHANICAL ENGINEERING , CENTER FOR NDE -IIT MADRAS, India, ¹Department of mechanical engineering , Indian Institute of Technology -Madras, India

Ultrasonic waveguide based sensing, that permit robust measurements and sensing, will be discussed in more detail in this work. The use of ultrasonic guided waves have several advantages including remote measurements, multi-modal nature allowing for measurement of different parameters, small footprint, low cost, multi-point measurements on the same waveguide and most importantly robustness. These inherent qualities of ultrasonic waveguide based sensing are particularly useful in industrial applications. One of the key application that will be described is the measurement of E (youngs modulus) and G (shear modulus) moduli of materials as a function of temperature over a wide range of materials will be demonstrated. Knowing the moduli as a function of temperature, the measurement of physical properties such as temperature, rheology, fluid level, etc. of the surrounding fluid material can be accomplished using several embodiments of the waveguides using the fundamental wave modes such as L(0,1), T(0,1) and F(1,1). In addition, it will be shown that under sodium imaging in large plant conditions can be performed using ultrasonic waveguides using the A0 modes. The same waveguide can also be used to measure vibration of immersed components in a power plant. Both experimental and finite element models will be demonstrated in this work.