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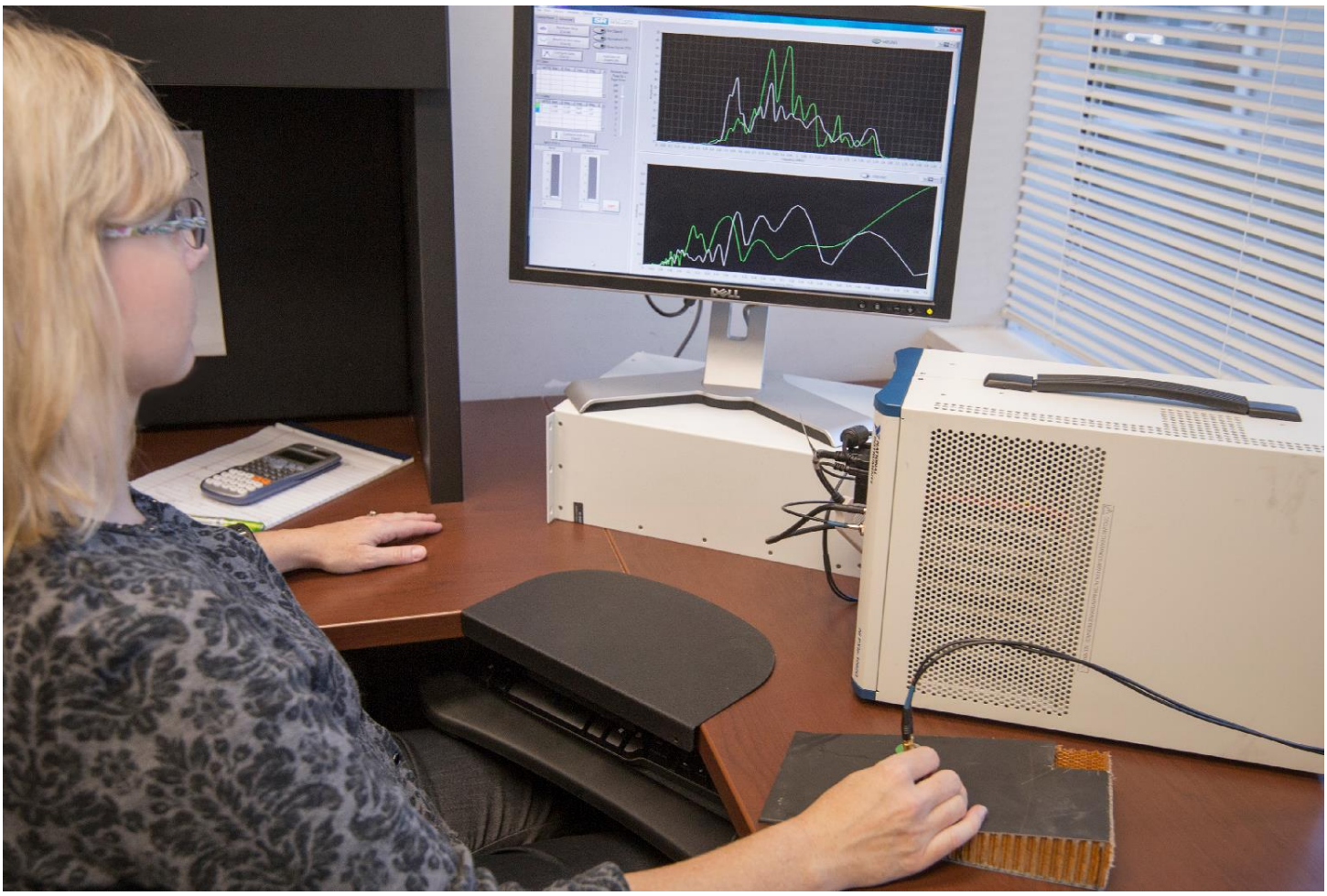
Ultrasonic Spectroscopy



Much research has been done verifying the use of ultrasonic spectroscopy to conduct nondestructive inspection of events not detectable by other means. However, the use of ultrasonic spectroscopy has been limited by inspection time, resolution, and signal-to-noise ratio. A new technique that overcomes these difficulties has been developed and patented by Kratos SRE.

The ultrasonic spectroscopy technique uses a swept-frequency input signal that can cover a wide range of frequencies in one waveform packet. The technique is able to provide substantial information on the resonance behavior of the material. Unlike other "resonance" or "pulse-echo" devices, the frequency range is user-definable and tailored to the material, not the transducer's distinct frequency. Input amplitudes can be adjusted to compensate for nonlinearities in the system so that attenuation as a function of frequency are viewed in real-time. The result of the new technique is a method of ultrasonic spectroscopy that is capable of performing inspections and analysis never before possible.

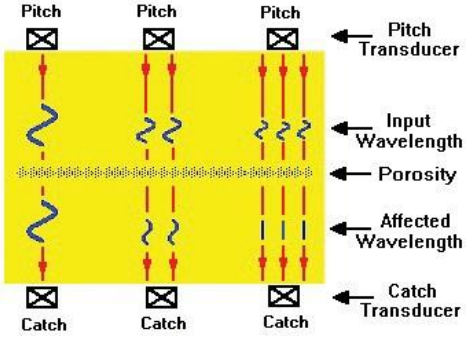
KratosSRE@KratosDefense.com **205.581.2412** **www.KratosDefense.com**

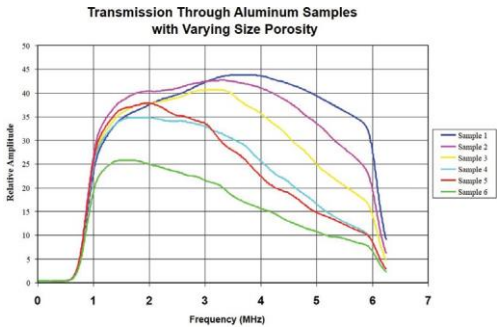
- ***Advantages of Kratos SRE's ultrasonic spectroscopy technique include:***

- Dramatically improved signal-to-noise ratio and dynamic range
- Flat input signal (square wave in frequency domain)
- Real-time scan rates
- Equipment can be used for on-site inspection

- ***Capabilities made available by Kratos SRE's ultrasonic spectroscopy technique and resulting applications include:***

- Evaluation of interaction of multiple wavelengths
  - › Detection of hidden corrosion
  - › Matrix characterization of composites
  - › Porosity detection and sizing
  - › Evaluation of metallurgical properties
- Resonant frequency determination
  - › Bond quality inspection
  - › Multiple layer inspection
  - › Precision thickness gauging
- Material property determination
  - › Measuring damping as a function of frequency
  - › Measuring velocity (modulus) as a functionof temperature (cryogenic to elevated)





As frequency increases, or wavelength decreases, the amplitude of the ultrasonic signal decreases. The defect can be estimated by the roll-off energy in the spectrum.

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