

ACOUSTICAL TRANSDUCER


ENGR 325

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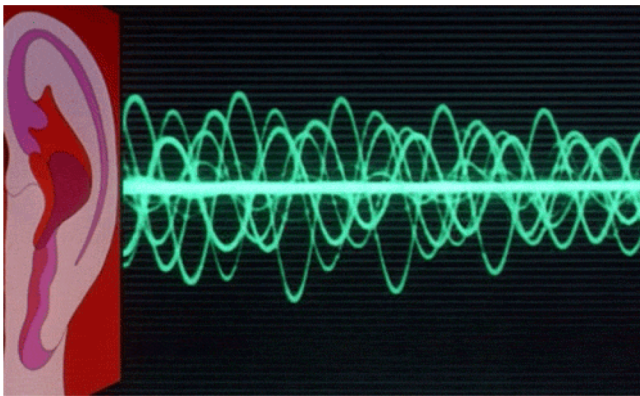
ACOUSTIC WAVES

- Mechanical waves propagate by inducing vibrations in the medium
- Acoustic waves are a type of mechanical waves which need a medium to propagate unlike Electromagnetic waves



ACOUSTIC TRANSDUCERS

- Transducers are devices that convert energy from one form to another
- Mainly concerned with the electroacoustic transducers



ACOUSTIC EMISSION

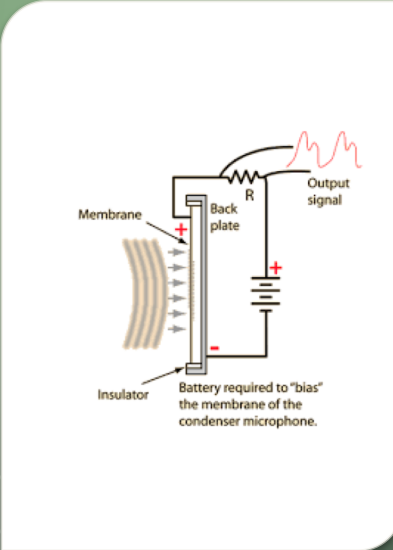
- Acoustic emission is a part of the transient response of a material as it undergoes changes in energy (def).
- Essentially, acoustic emission can be used to measure a wide variety of variables (pressure, temperature, strain, etc.)

MICROPHONE SOUND TRANSDUCER

- A moving coil to generates electrical signals from sound waves
- Pressure causes the attached coil of the wire to move within the magnetic field
- Magnetic field causes a voltage to be induced in the coil
- Resultant output voltage signal from coil is proportional to the pressure of the sound wave.
- The coil is a low impedance inductor, the output of the voltage is very low—"pre-amplification" is required

THE LOUDSPEAKER TRANSDUCER

- The construction of a dynamic loudspeaker resembles the microphone, but in reverse.
- Analogue signal passes through the voice coil of the speaker, the electro-magnetic field is produced. The electro-magnetic force opposes by the magnetic field and tries to push to coil. Hence, create air movement which will create sound



The diagram illustrates the internal components of a condenser microphone. It shows a curved membrane on the left, an insulator below it, and a flat back plate on the right. A battery is connected to the back plate (positive terminal) and the membrane (negative terminal). A resistor labeled 'R' is connected in series with the membrane. An output signal is shown as a red waveform coming from the resistor. A caption below the diagram reads: 'Battery required to "bias" the membrane of the condenser microphone.'

MICROPHONE

- As sound waves vibrate the membrane, changing the capacitance.
- Charge on the membrane depends only upon the spacing.
- When the spacing changes, the charges changes, giving an electric current through the resistor R
- Voltage measured across the resistor is an electrical image of the sound pressure with moves the membrane.

Pros

- _____ Inexpensive
- _____ Durable
- _____ Variety of sizes & uses
- _____ Data can be interpreted in real time

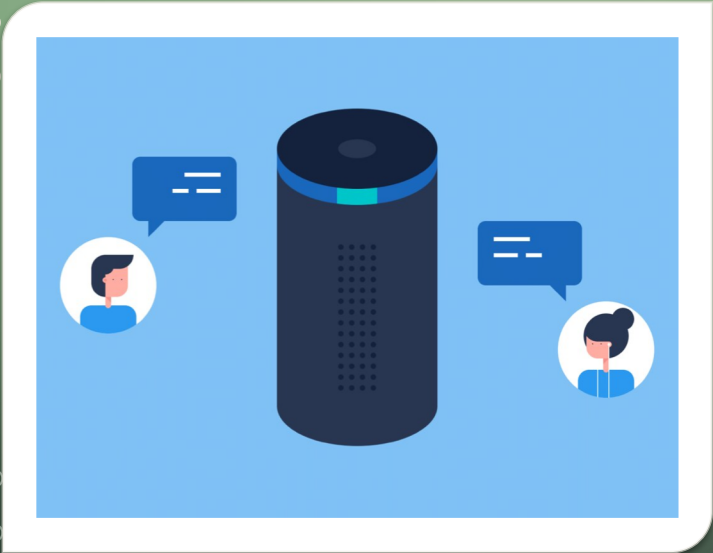
Cons

- _____ Noisy to temperature, pressure and humidity effects
- _____ Lag time between measurements and experiments
- _____ Tracking correct directional data can be tricky



ACOUSTIC EMISSION APPLICATIONS

- Acoustic emission testing (AET) can perform nondestructive testing.
- AET is generally used as a monitoring/quality control technique in manufacturing, but there are many other applications...



OTHER APPLICATIONS

- Explosion Characteristics, fuel qualities & gunshot detection.
- Voice Recognition, Amazon's Alexa, Apple's Siri, & Microsoft's Cortana.
- Ultrasonic Testing, both medical & for manufacturing.

