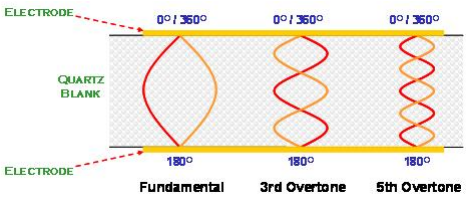
Ultra SONIC Sensing

by Kevin Corrigan, Ivan Snyder, and Eric Welch

Applications

- Liquid Level Sensing
- Automation
- Contouring or Profiling
- Box Sorting using a Multi-Transducer System
- Pallet Detection with Forklifts
- Bottle Counting on Drink Filling Machine
- Ultrasound - Medical

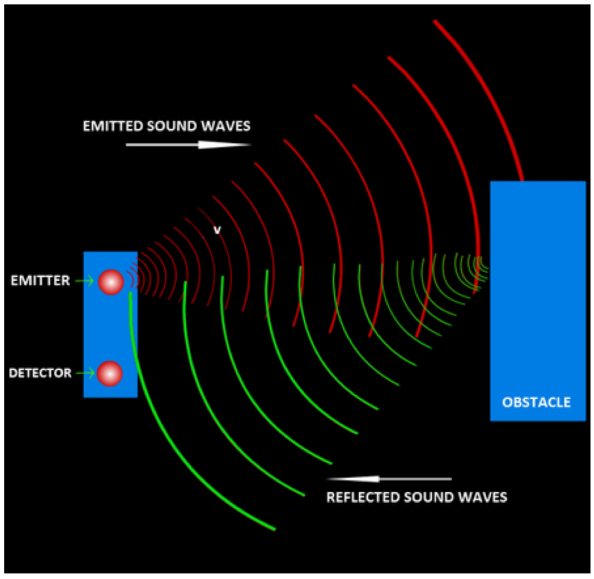
Frequency Production



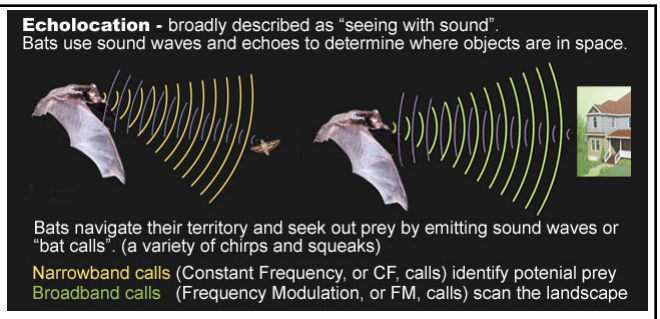
- Resonant Frequencies
- Matching half the AC wavelength to the thickness of crystal
- Polished surfaces of crystals mask lower harmonics
- 9th and 11th with greatest amplitude

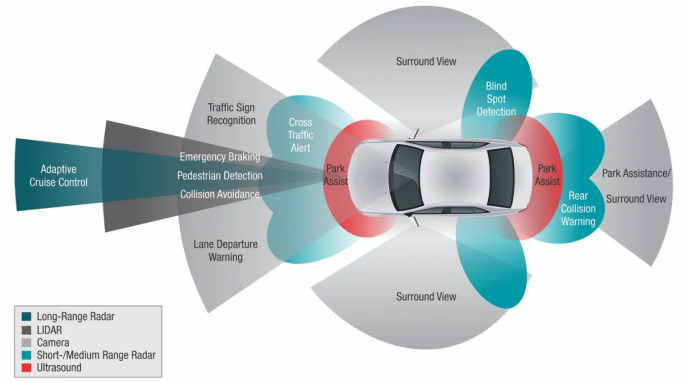
Distance Sensing Basics

- D = ½ T * C
- Time
- Speed of Sound



Collision Avoidance





Ultra

Pros

- Their small size makes it easy to integrate into projects
- Easy to integrate into systems
- High sensitivity / accuracy
- Minimal harm / safe
- Relatively cheap

Cons

- Limited detection range (10m)
- Soft surface interference
- Temperature sensitive (5-10^{o})
- Useless in a vacuum

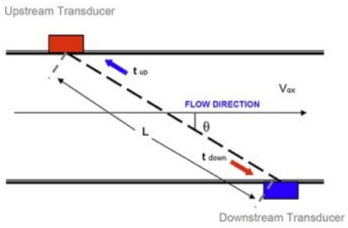
Flow

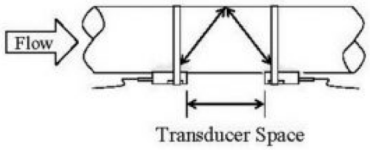
- Transit Time Ultrasonic Flow Meters

$$v = \left(\frac{L}{2\cos(\alpha)}\right)\left(\frac{t_{up} - t_{down}}{t_{up} t_{down}}\right)$$

- Doppler Ultrasonic Flow Meters

$$f = f_0\left(\frac{c \pm v_r}{c \pm v_s}\right)$$





Pros:

- Not invasive
- Good for corrosive, abrasive, or sanitary environments
- Not effected by Temperature

Cons:

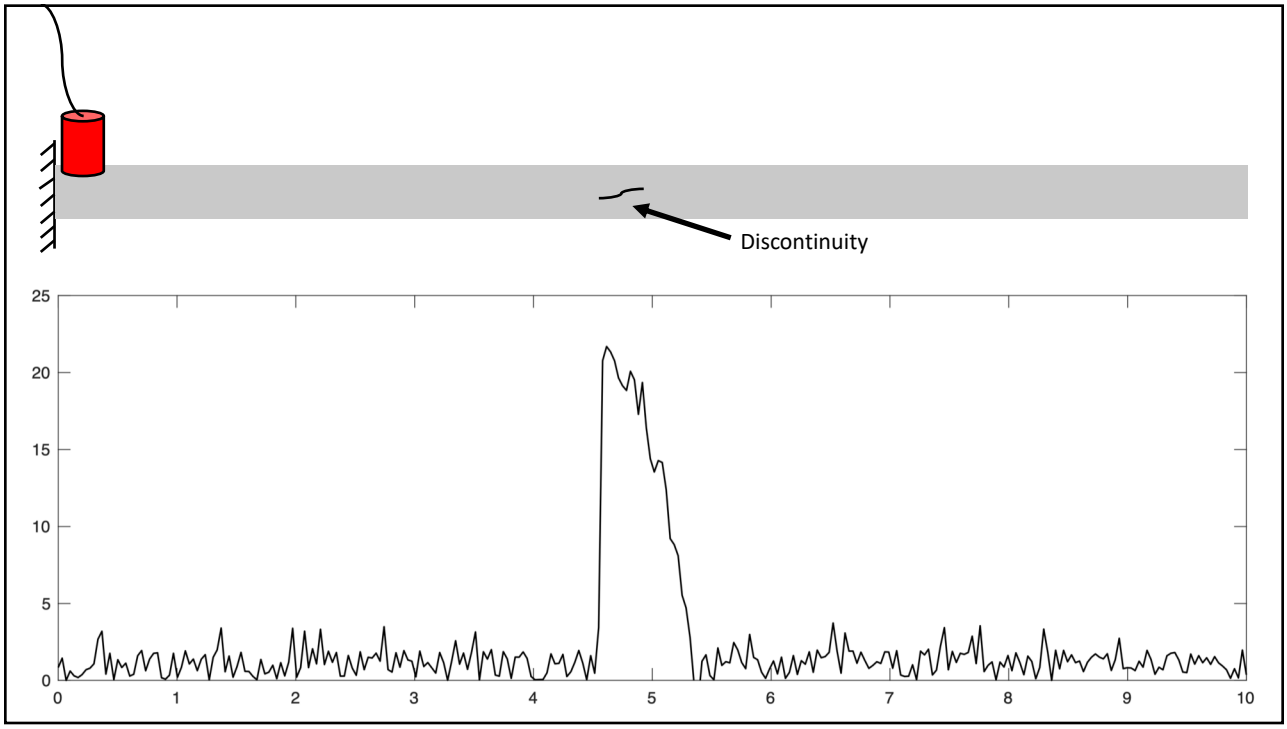
- Pipes and equipment must be kept clean
- Not great for fluids caring solid particulates
- Effected by vibrations

Applications

- Zero point calibration
- Pulse Totalizer
- 4-20 milliamp loop

Material Testing

- Pulse-echo inspection system
- Wave propagation is affected by material properties
- Discontinuities reflect waves back to transducer



References

- https://www.bostonpiezooptics.com/intro-to-transducer-crystals
- https://www.maxbotix.com/articles/how-ultrasonic-sensors-work.htm
- https://www.fierceelectronics.com/sensors/what-ultrasonic-sensor
- https://en.wikipedia.org/wiki/Medical_ultrasound
- https://www.maxbotix.com/articles/ultrasonic-sensor-applications.htm
- https://www.maxbotix.com/articles/ultrasonic-sensor-applications.htm
- https://www.ebatremoval.com/60-day-trial-offer/do-bat-removal-devices-work/
- https://www.nde-ed.org/EducationResources/CommunityCollege/Ultrasonics/Introduction/description.htm
- https://eis.hu.edu.jo/ACUploads/10526/Ultrasonic%20Testing.pdf

Questions?

MOUNTAIN DEW POPCORN

$3.00 – $45.00

★★★★★ (1 customer review)

Your mouth won't be sure if you're drinking Mountain Dew while you eat our yummy Mountain Dew flavored popcorn!

We take our fresh-popped, fluffy kernels of Kansas corn and coat them generously with taste-tastic Mountain Dew flavored coating for a party in your mouth. Whether you order this delicious treat for yourself, or enough for the whole fan-damily, Popt!'s **Mountain Dew popcorn** is sure to hit the spot.

Our **Mountain Dew gourmet popcorn** is also available in our popcorn gift boxes and tins – the perfect *gift idea for the popcorn lover* in your life. *Order Mountain Dew popcorn online* today from Popt! Gourmet Popcorn!

Bag Size

Choose an option

1 + - ADD TO CART