

Basic notions of acoustic remote sensing

Marco Dalai

marco.dalai@ing.unib.it

Department of Information Engineering

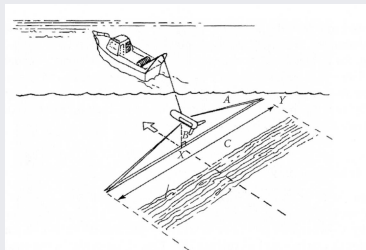
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SONAR (SOund Navigation And Ranging)

- System using acoustic waves in water
- Active and passive sensors
 - Active: they emit sounds and listen to echoes
 - Passive: they only listen (e.g., 50/60Hz for E.U./U.S. vessels)
- Applications: navigation, army, bathymetry, fishing,
- Echo sounding: when the sound wave is directed vertically to measure the depth of a sea or a lake floor (bathymetry)
- Side Scan Sonar: a sonar with two main lateral lobes in opposite directions used to study the shape of the seafloor surface and/or of objects on the seafloor (e.g., archeology)

SODAR (Sonic Detection And Ranging)

- Ultrasonic waves in the atmosphere
- Meteorology

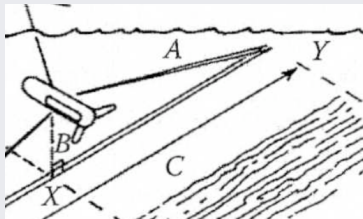
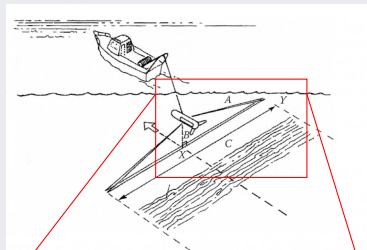


- Ultrasonic impulses
 - Very short pulses are emitted by the source
 - The time-of-flight of the reveals the distance from the target

$$d = \frac{1}{2}vt$$

- The distance B is estimated and then A and C
- The shape of the floor is thus reconstructed

Side Scan Sonar

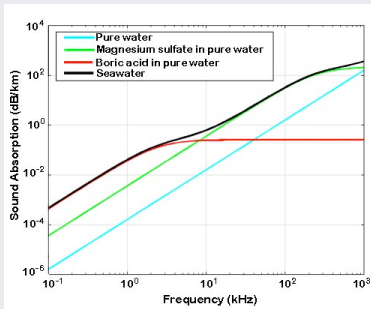
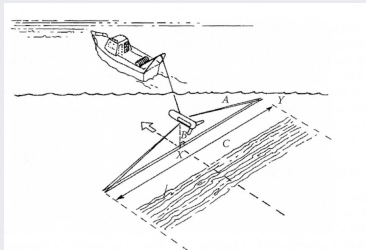


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Side Scan Sonar



- Some details:
 - Near 2° of horizontal beamwidth of and 20° of vertical beamwidth
 - There is a trade-off between resolution and achievable distances
 - Example: with impulses in the range of 50-500 KHz a resolution of 20-50 cm can be achieved with pulses of 0.1ms, but the maximum distance is near 400 m. For a “poorer” resolution lower frequencies can be used which allow to sense at largest distances.