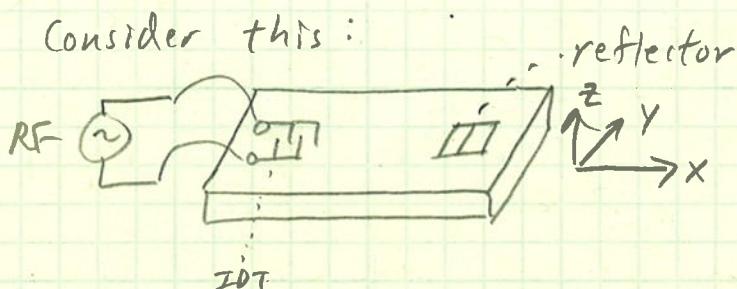


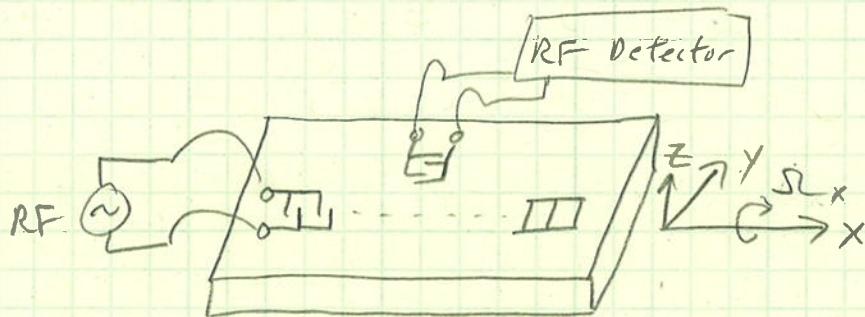
1. SAW Gyroscope

Consider this:



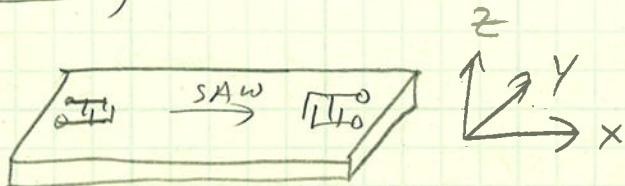
If a Rayleigh wave is launched, it will be reflected back and set up a standing wave with nearly motionless z -axis nodes and high amplitude z -axis antinodes.

→ at the antinodes, substrate particles experience vibratory motion → Drive Mode



If the substrate is rotated about the x -axis, Ω_x , The Coriolis force, $|F_c| = 2m\dot{z}\Omega_x$, will launch an acoustic wave in the y -direction, which is detected by the second, orthogonal IDT, where SAW amplitude is proportional to Ω_x .

2. Mass Sensing



Rayleigh waves have a vertical component.

Any material depositing on the substrate surface can perturb the acoustic wave and be detected
examples : dew (condensation)

species specific bacteria onto a monolayer
dust and other particulates

3. Ice Sensing

→ Love waves are shear only (parallel to surface and orthogonal to wave propagation)

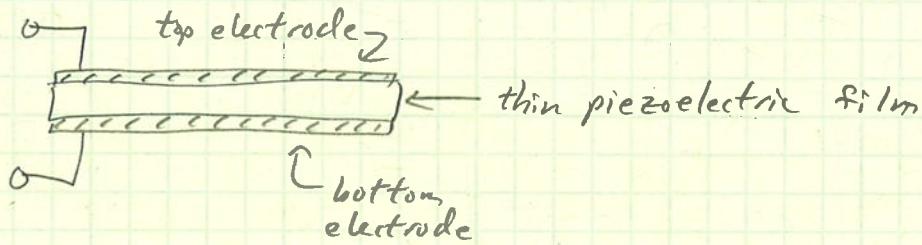
→ substrate contact with gas has no effect on SAW

→ " " " liquid " little " " proportional to liquid's velocity ↗

→ if water freezes on substrate → bound solid greatly affects Love wave and is detectable

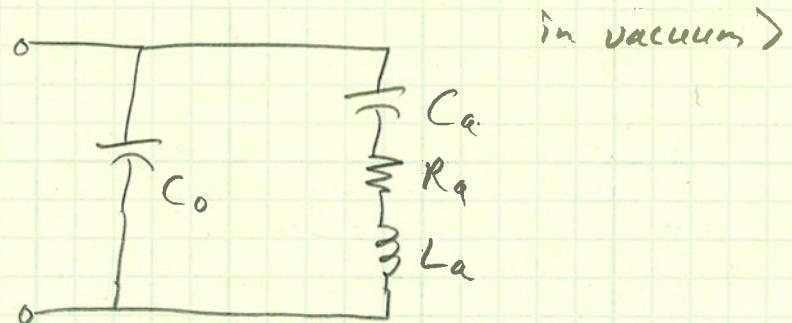
4. Bulk Acoustic Wave (BAW) Devices

Basic structure \rightarrow thin piezoelectric film between two thin metal electrodes



The device is a high Q electrical resonator (often packaged in vacuum)

Electrical model:



Optimal frequency range: typically above 1.5 GHz

\rightarrow often tied together in series and parallel to realize ladder structures for filters

\rightarrow sensors ?