1. SAW Sensors

"SAW" → Surface Acoustic Wave"

→ using a special substrate, an RF signal is transduced into an acoustic wave that propagates down the substate along or near the surface, and is transduced back into an RF signal at the other end.

→ acoustic wave velocity << c. $\{3\times10^8$ m/s$\}$

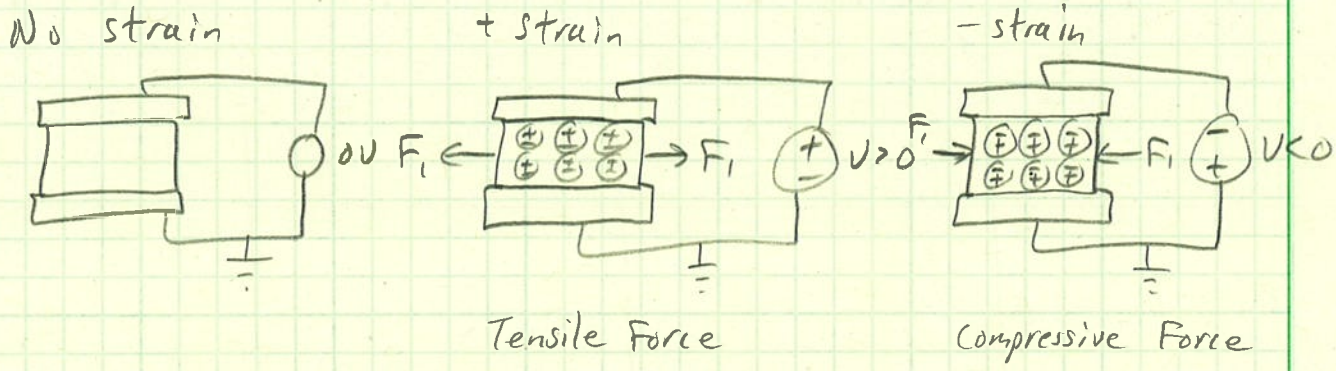
∴ there is a measurable delay between the transduction events

→ uses : (1) a delay line
(2) an oscillator
(3) a filter
(4) a sensor → any measurand that affects the acoustic wave propagation {delay time, amplitude} can be sensed

a. The SAW Substrate

→ a piezoelectric crystal
↳ a crystalline material unlike single crystal Si, where deformation of the crystalline lattice produces a separation of the centers of gravity of positive and negative charges

→ application of an external force strains the crystal, resulting in charge build up on opposite surfaces where electrodes have been placed



The piezoelectric effect is reversible

Applied deformation produces electric field → piezoelectric effect

Applied electric field produces mechanical deformation → converse piezoelectric effect

Piezoelectric crystal type and cut determine the effect: "ST cut" → "stable temperature cut"

cut refers to crystal orientation

<u>Example Piezoelectric materials</u>

quartz, PZT
barium titanate
lithium niobate
zinc oxide
} any many others

Also some polymers (ex: PVDF), dry bone, silk, DNA and some other biological materials

<u>Other applications</u>: MEMS actuator and strain sensor, Generation of high voltages