DAY "0" → FOURIER DOMAIN

DAY "1" → NOISE / UNIT JUGGLING

DAY "2" → CONTROL

TRANSFER FUNCTION

$[m] \rightarrow Y(f) = H(f)\,V(f) \leftarrow [m/s]$

$Y(f)$: ASD, $V(f)$: ASD

$$H_1 = \frac{C_{VY}(f)}{P_{VV}(f)} = \frac{[m/s][m]/[Hz]}{[m/s][m/s]/[Hz]} = \frac{[m]}{[m/s]}$$

$$H_2 = \frac{P_{YY}(f)}{C_{VY}(f)}$$

$$C = \gamma^2 = \frac{H_1}{H_2}$$

$\tilde{A}_{VV}(f)$ = ASD → "POWER SPECTRAL DENSITY"

"PERIODOGRAM"

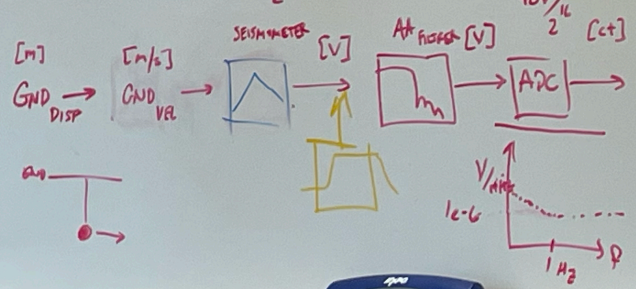
"AUTO CORRELATION" $\tilde{P}_{VV}(f)$

CROSS CORRELATION

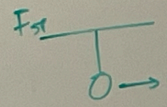
$$\tilde{C}_{YV}(f) = \frac{1}{TN}\left(\sum_{n=0}^{N-1} v\, e^{2\pi i f t/T}\,\Delta t\right)\left(\sum_{n=0}^{N-1} y\, e^{2\pi i f t/T}\,\Delta t\right)$$

$[m/s]$ $[m]$

$= [m/s][m]/[Hz]$




How A SEISMOMETER WORKS → MODEL A TRANSFER FUNCTION




$$F_{SP} = +M\ddot{x}_{PM} - B\dot{x}_{PM} - kx_{PM}$$

$$= M\left(-\ddot{x}_{PM} - \frac{B}{M}\dot{x}_{PM} - \frac{k}{M}x_{PM}\right)$$

$$x = \frac{1}{i\omega}\dot{x}$$

FOURIER TRANSFORM

$x = Ae^{i\omega t}$

$\dot{x} = i\omega x$

$\ddot{x} = -\omega^2 x$

$$= M\left(\omega^2 x_M + i\frac{B}{M}\omega x_{PM} - \frac{k}{M}x_{PM}\right)$$

$$\frac{k}{M} \equiv \omega_0^2 \qquad \frac{B}{M} = \omega_0/Q$$

$$F_{SP} = M x_{PM}\left(\omega^2 + i\frac{\omega_0}{Q}\omega - \omega_0^2\right)$$

$$\frac{x_{PM}}{F_{SP}} = \frac{1}{M}\,\frac{1}{\left(\omega^2 + i\,\omega/Q\,\omega - \omega_0^2\right)}$$