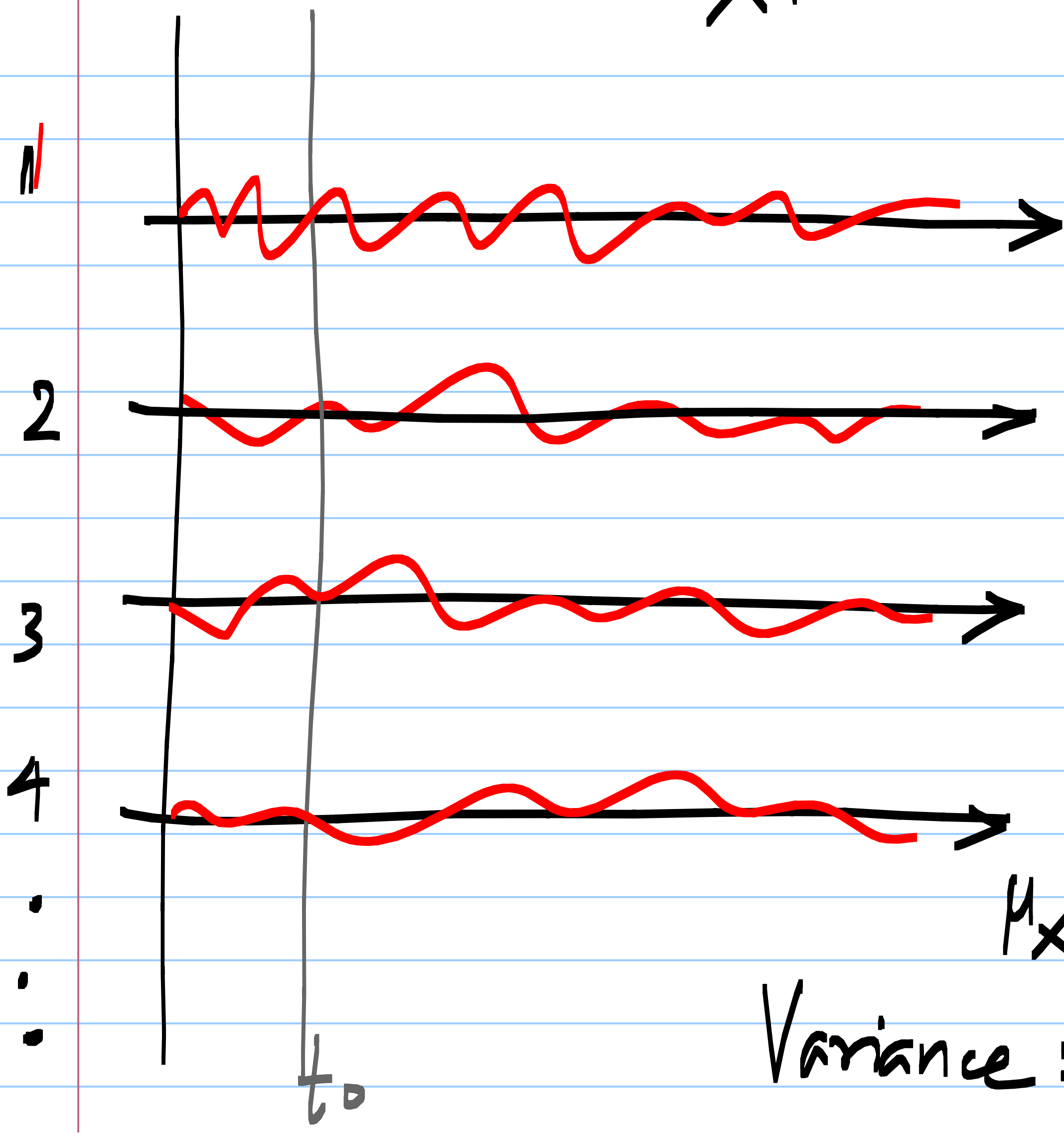
Random process



X:

Probability density function:

$p_X(x)$

Probability of X being in $(x_0, x_0+\Delta x)$

$= p_X(x_0)\cdot\Delta x$

$E[X]$

Mean: μ_X $\displaystyle\int_{-\infty}^{\infty} x\cdot p_X(x)\,dx$

Variance: $E[(X-E[X])^2] = \sigma_X^2$

Stationary: Mean & variance: same at all 't'

Wide-sense

Ergodicity: Mean $E[x]$ = $\underbrace{\lim_{T\to\infty} \frac{1}{T}\int_{-T/2}^{T/2} x(t)\,dt}_{\text{time average}}$

{Ensemble}

$\sqrt{\ }$: Standard deviation σ_x

Variance $E[(x - E(x))^2]$ = $\lim_{T\to\infty} \frac{1}{T}\int_{-T/2}^{T/2} (x(t) - \bar{x})^2\,dt$

σ_x^2 [Ensemble]

$\sqrt{\ }$ rms

Mean squared value

Auto correlation: (Zero mean)

$$R_X(t,\tau) = E\left[X(t)\cdot X(t+\tau)\right]$$

$$R_X(\tau) = E\left[X(t)\cdot X(t+\tau)\right] = \int_{-\infty}^{\infty} p_X(x)\cdot x(t)\, x(t+\tau)\cdot dx$$

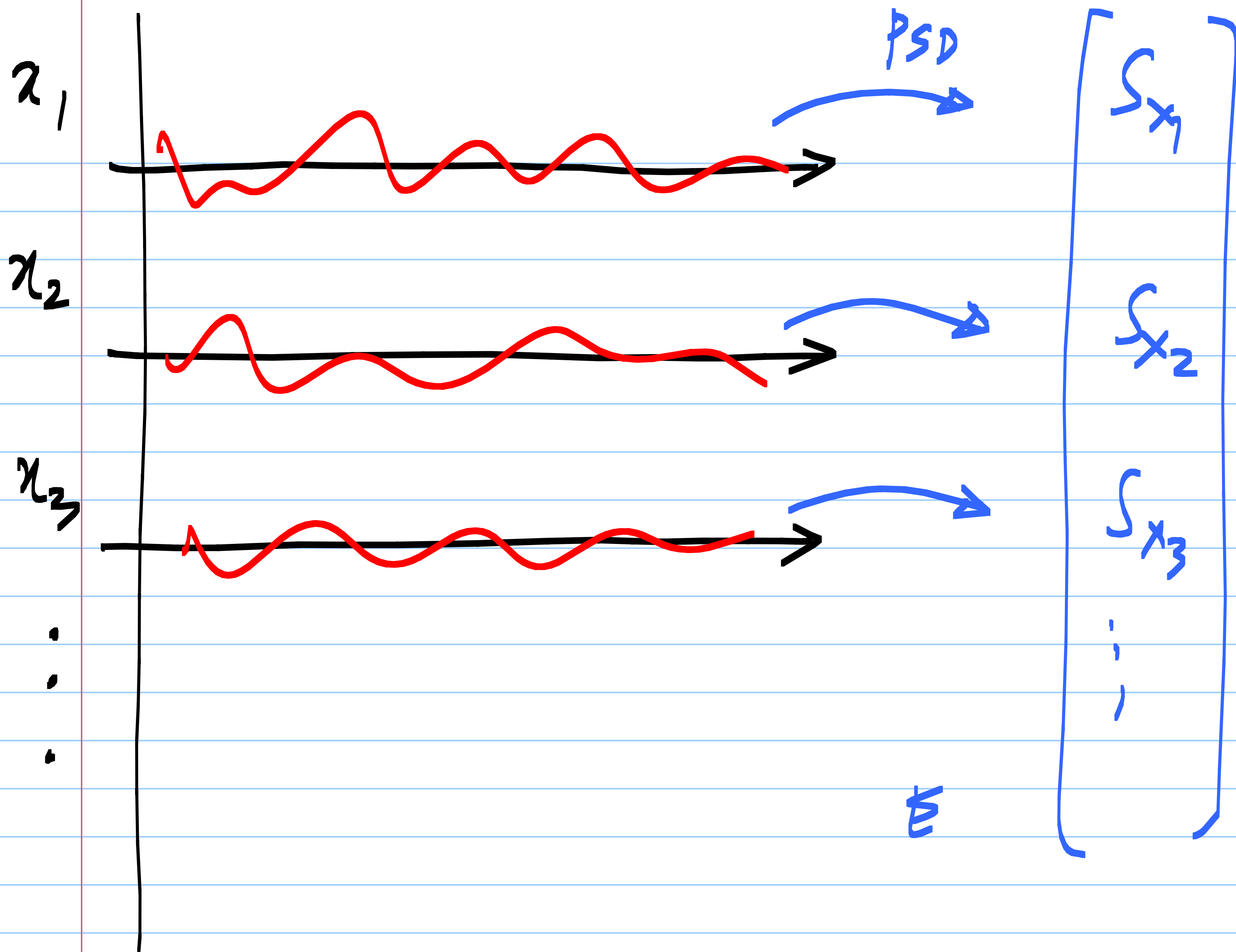
$$R_X(0) = \sigma_X^2$$

Variance

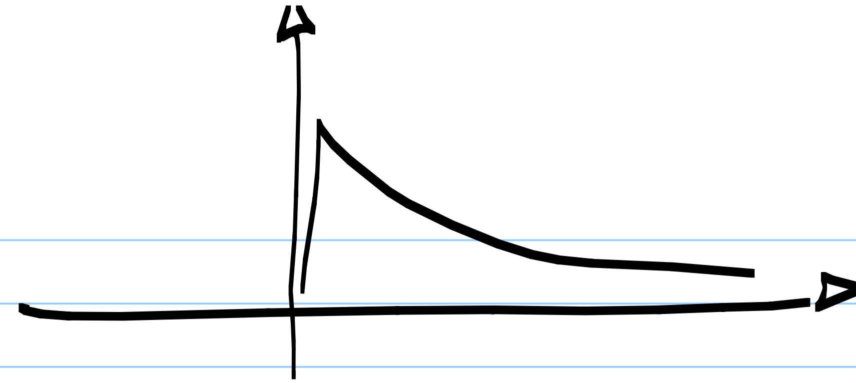
Power spectral density

F.T

$$\int_{-\infty}^{\infty} R_X(\tau)\cdot \exp(-j2\pi f\tau)\cdot d\tau = \underbrace{S_X(f)}$$

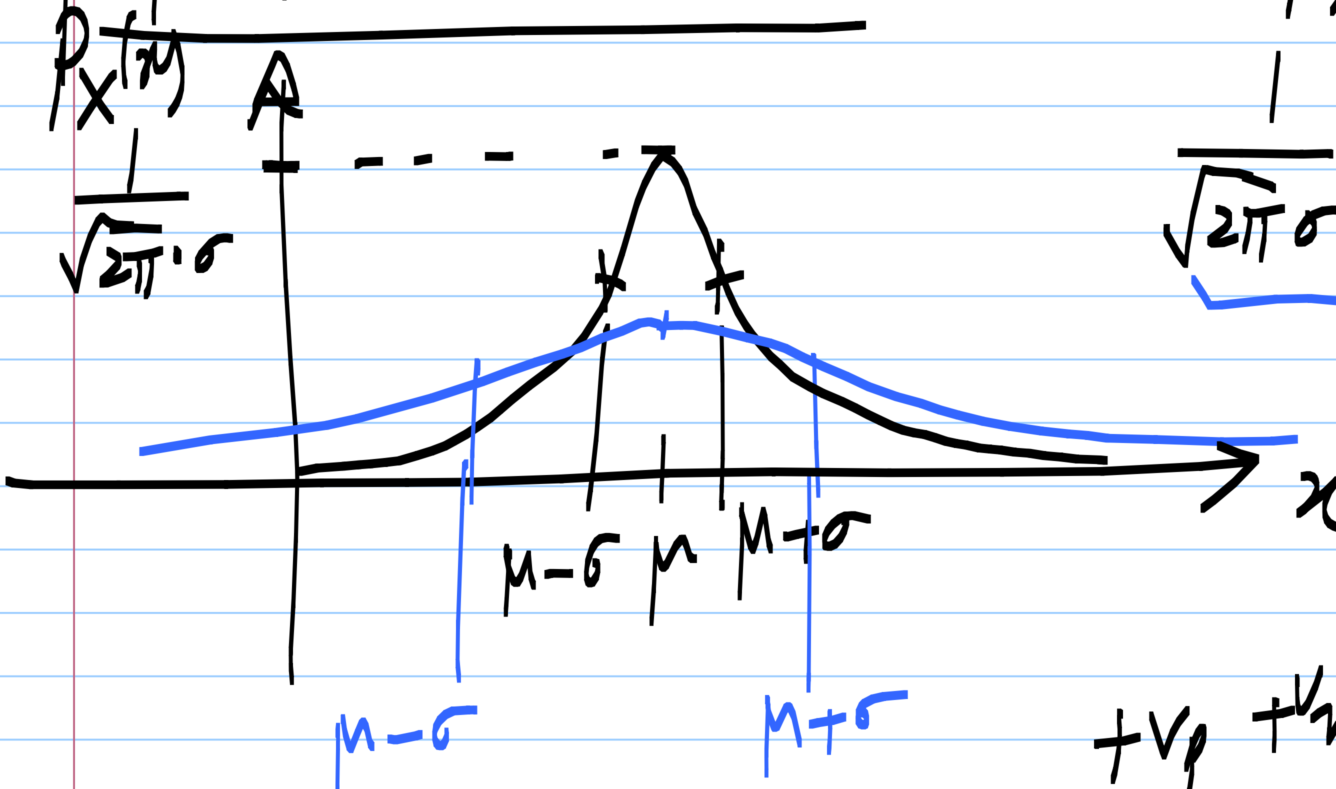

x1
x2
x3
PSD
Sx1
Sx2
Sx3

$$x(t) = \exp(-at) \cdot u(t)$$



$$X(f) \quad \left(\frac{1}{a + j\cancel{\omega}2\pi f} \right)$$

Gaussian distribution:



$$p_X(x) = \underbrace{\frac{1}{\sqrt{2\pi}\,\sigma}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

$N(\mu, \sigma)$

$+V_p \; +V_n$

$-V_p \; +V_n$