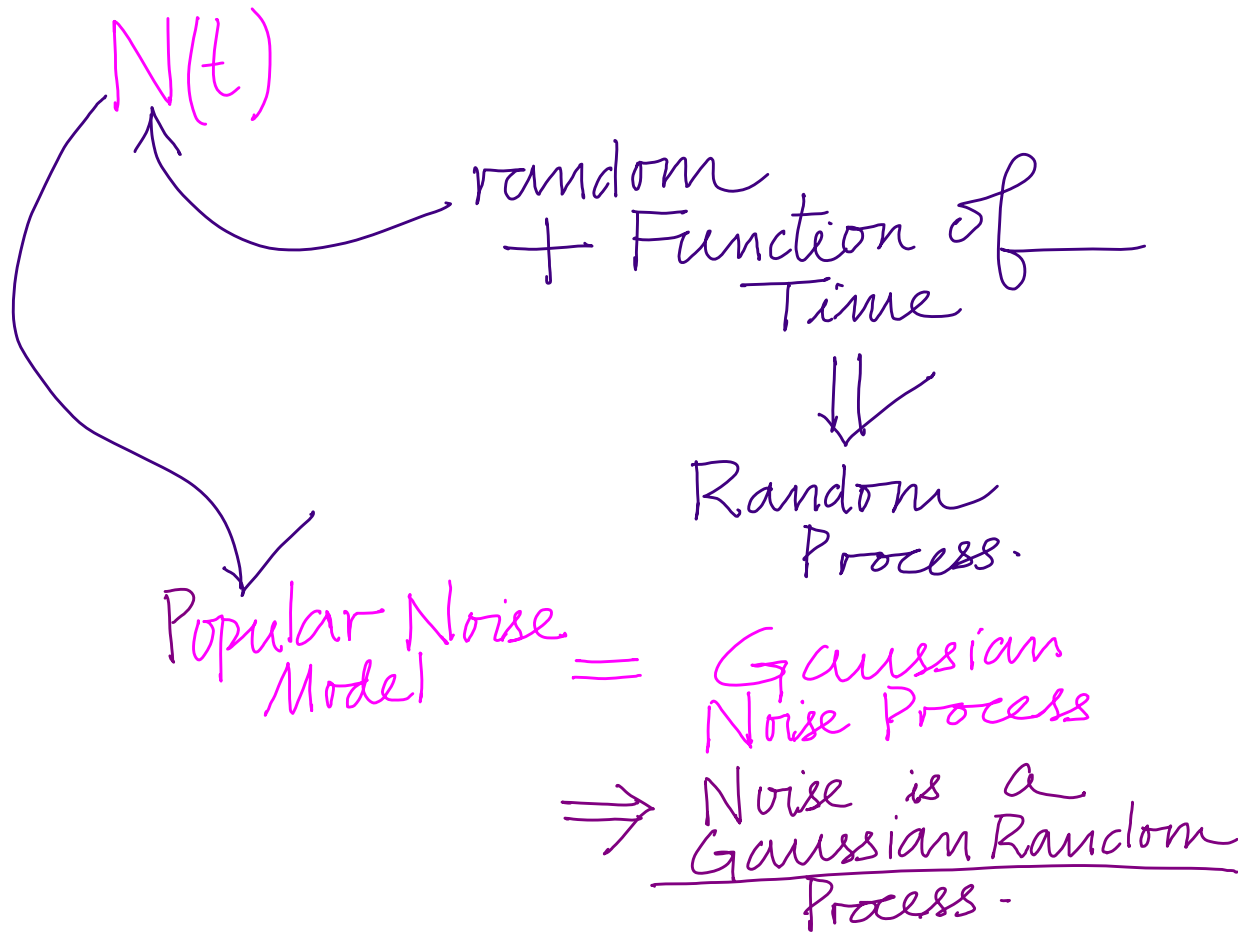




Gaussian Random Process

$N(t)$ — is a Gaussian Random process, if statistics of all orders are Jointly Gaussian

This means:

Consider noise samples

$$N(t_1), N(t_2), \dots, N(t_k)$$

k Noise samples.
at times $t_1, t_2, \dots, t_k$.

$$\begin{matrix} & (n_1, n_2, \dots, n_k) \\ \left[\right. & N(t_1), N(t_2), \dots, N(t_k) \end{matrix}$$

Joint Distribution of
Noise samples.

✓ If this is Jointly Gaussian
i.e. Follows a Multivariate
Gaussian Density.

For all $t_1, t_2, \dots, t_k$.
For all k .

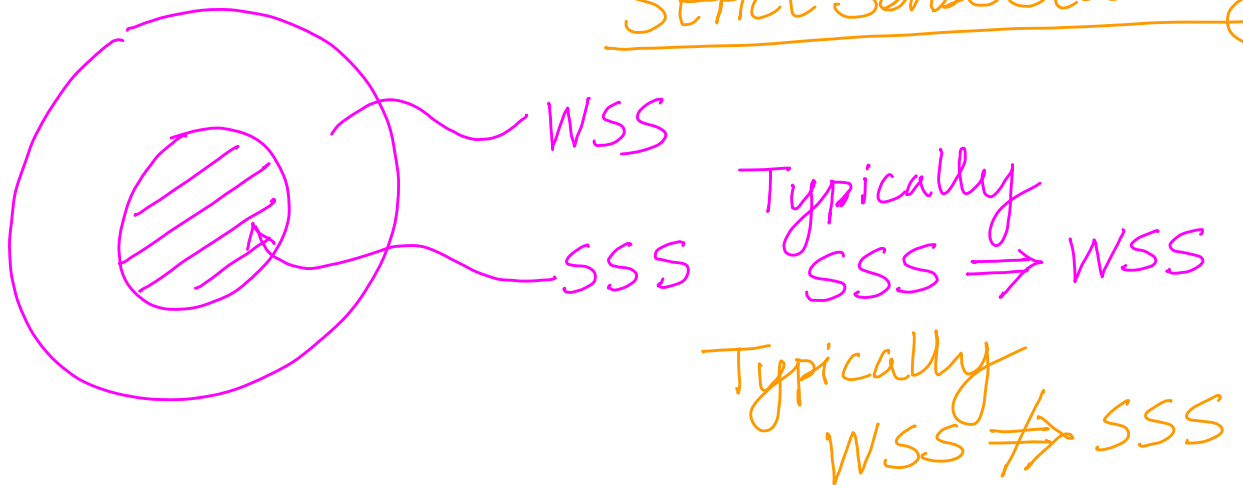
✓ Then termed as a Gaussian
Random Process.

$$\text{Noise} + \text{Gaussian Random Process} = \text{Gaussian Noise.}$$

Gaussian Noise Process.

→ IF WSS i.e.
Wide Sense Stationary

⇓
It is also SSS.
Strict Sense Stationary



Only for a Gaussian Random Process

$$\boxed{WSS \Rightarrow SSS.}$$

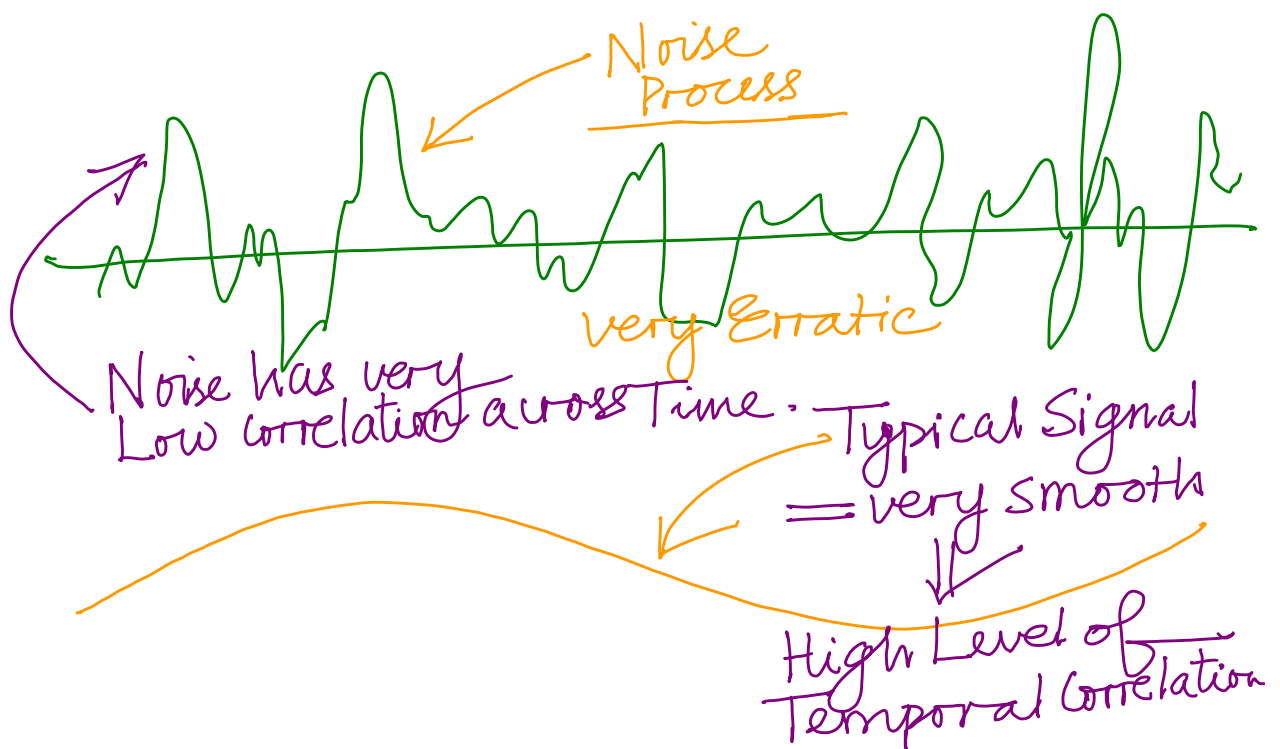
$N(t)$ is WSS if,

Conditions for WSS. $\left\{ \begin{array}{l} E\{N(t)\} = \mu \quad \forall t \\ E\{N(t)N(t+\tau)\} = R_{NN}(\tau) \quad \forall t, \tau \end{array} \right.$

Depends only on Time Difference τ .

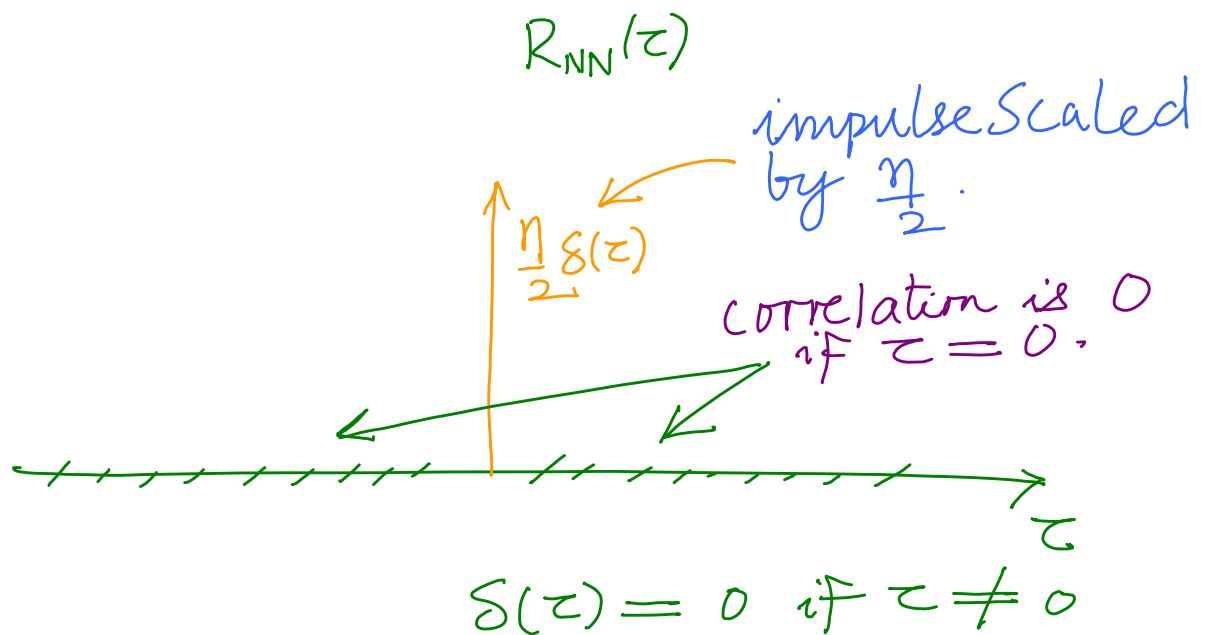
WHITE NOISE:

Noise typically has very low correlation.



$$R_{NN}(\tau) = E\{N(t)N(t+\tau)\} = \frac{\eta}{2} \delta(\tau).$$

Correlation between $N(t)$, $N(t+\tau)$.



$$E\{N(t)N(t+\tau)\} = 0 \text{ if } \tau \neq 0.$$

$$R_{NN}(\tau) = \frac{\eta}{2} \delta(\tau)$$

White Noise.

Noise samples at any two Different time instants $t, t+\tau$ are uncorrelated.

auto-correlation

$$R_{NN}(z) = \frac{\eta}{2} \delta(z)$$

F.T. F.T.

Power Spectral Density

$$S_{NN}(f) = \frac{\eta}{2}$$

