Power Density Spectrum - Discrete Time

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Based on
Probability, Random Variables and Random Signal Principles,
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Outline

Definition

$$S_{XX}(z) = \sum_{n=-\infty}^{\infty} R_{XX}[n] z^{-n}$$

Definition

$$S_{XX}(e^{j\Omega}) = \sum_{n=-\infty}^{\infty} R_{XX}[n]e^{-jn\Omega}$$

$$R_{XX}[n] = \frac{1}{2\pi}\int_{-\pi}^{+\pi} S_{XX}(e^{j\Omega})e^{jn\Omega}d\Omega$$

Properties of Power Density Spectrum - DT
N Gaussian random variables

1. $S_{XX}(e^{j\Omega}) \geq 0$
2. $S_{XX}(e^{-j\Omega}) = S_{XX}(e^{+j\Omega})$ for real $X[n]$
3. $S_{XX}(e^{+j\Omega})$ is real
4. $\frac{1}{2\pi}\int_{-\pi}^{+\pi} S_{XX}(e^{j\Omega})d\Omega = E[X^2[n]]$