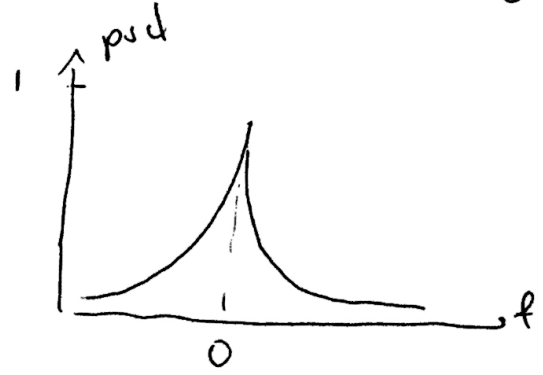
Shanmugan

Problem 3.16

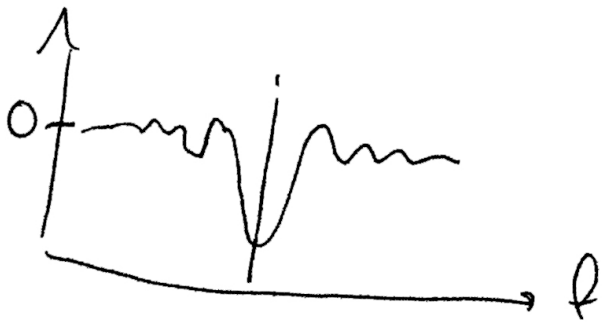
a) Can $S_X(f) = (1 + 10 f^2)^{-\frac{1}{2}}$ be a psd for a real-valued WSS random process?

Yes since the function is real and nonnegative and even.



b) $$psd = \frac{\sin 1000 f}{1000 f}$$

No. sin the function is not non-negative.

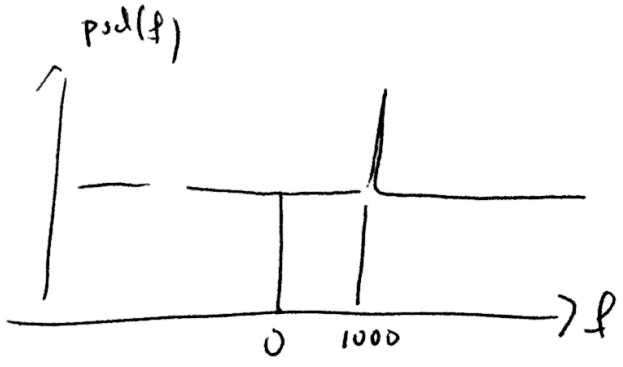


problem 3.16

c)

$psd(f) = 50 + 20\,\delta(f - 1000)$

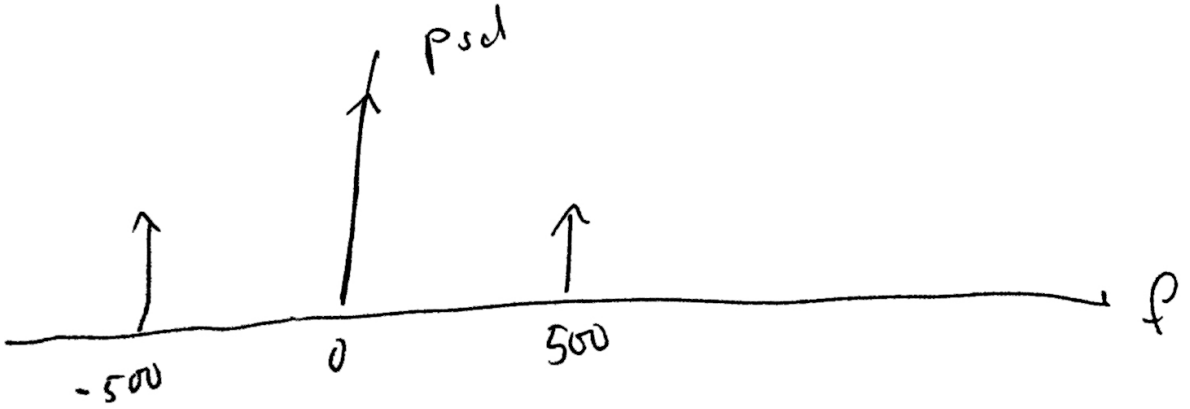
No, since the function is not even.



d)

$psd(f) = 10\,\delta(f) + 5\,\delta(f + 500) + 5\,\delta(f - 500)$

Yes, since it is real, non-negative and even.



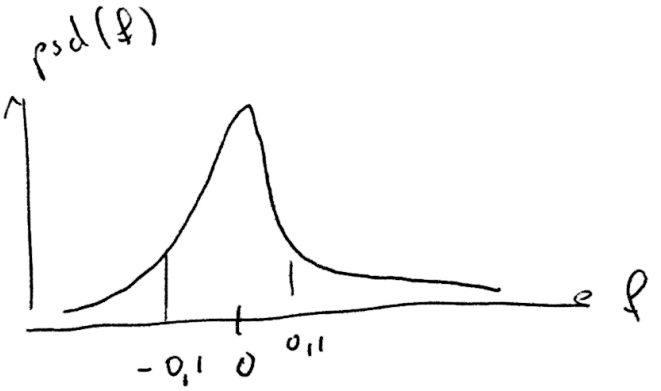
Shanmugan

problem 3.16

e) ~~psd(f)~~

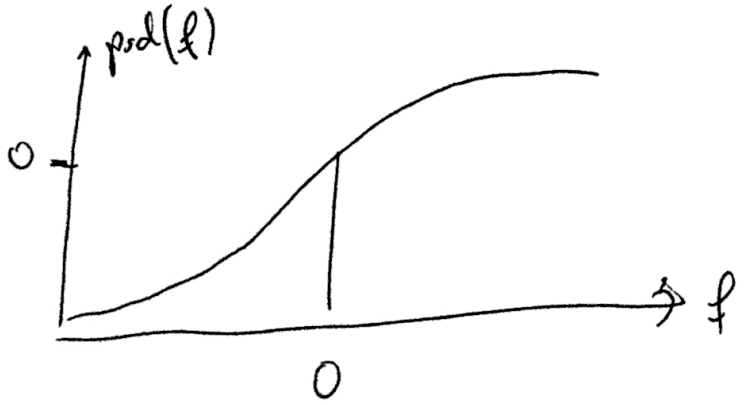
$$psd(f) = \exp(-200\pi f^2)$$

Yes, since it is real, nonnegative an even.



f) $$psd(f) = \frac{f}{(f^2+100)}$$

No, since it is not non-negative and not even



Shanmugan

problem 3.17

a) For $R_{xx}(\tau) = \exp(-\alpha|\tau|)$ $\quad \alpha > 0$

$$S_{xx}(f) = \mathcal{F}\{R_{xx}(\tau)\}$$

$$= \mathcal{F}\{e^{-\alpha|\tau|}\}$$

$$= \frac{2\alpha}{\alpha^2 + (2\pi f)^2}$$

b) For $R_{xx}(\tau) = \frac{\sin 1000\tau}{1000\tau}$

$$S_{xx}(f) = \mathcal{F}\{R_{xx}(\tau)\}$$

$$= \frac{1}{1000}\,\text{rect}\left(\frac{f}{1000}\right)$$