

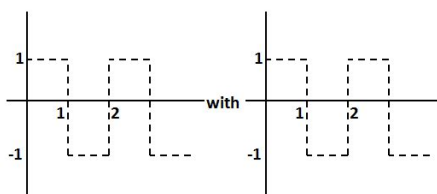
1. Continuous Time Cross Correlation

The formula for the continuous time cross-correlation for periodic signals $x(t)$ and $y(t)$, both with period T is

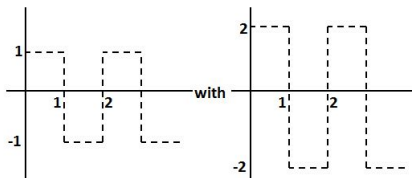
$$R_{xy}(\tau) = \int_{\langle T \rangle} x(t)y^*(t + \tau)dt$$

Find the cross-correlation of the following signals:

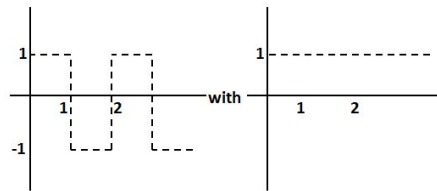
- (a) A square wave with itself



- (b) Square wave from above and square wave with twice the amplitude



(c) Square wave from part (a) and 1



(d) $\cos(\omega t)$ and $\cos(\omega t + \phi)$

2. Spectrum Draw the spectrum for the following signals with frequency on the x-axis

(a) $\sin(\omega t)$

(b) $\sin(\omega t) + \sin(2\omega t)$

(c) $\sin(\omega t) + \cos(\omega t)$

3. Taylor Swift vs. Pharrell Williams

Imagine your friend challenges you to find which singer is on air by just looking at the frequency component. The two frequency plots look like what is shown below. Which frequency spectrum belongs to which singer?

