EE3900 Quiz-2

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Download all python codes from

https://github.com/vrahul02/EE3900/tree/main/Quiz−2/Codes

and latex-tikz codes from

https://github.com/vrahul02/EE3900/tree/main/Quiz−2/Quiz−2.tex

Problem 3.13

A causal sequence $g[n]$ has the z-transform $G(z) = \sin z^{-}1\,(1 + 3z^{-}2 + 2z^{-}4)$.
Find $g[11]$.

Solution

$$G(z) = \sin z^{-}1\,(1 + 3z^{-}2 + 2z^{-}4) \tag{0.0.1}$$

Using the series expansion of $\sin x$,

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ... \tag{0.0.2}$$

We get,

$$\sin z^{-}1 = z^{-}1 - \frac{z^{-}3}{3!} + \frac{z^{-}5}{5!} - \frac{z^{-}7}{7!} + ... \tag{0.0.3}$$

$$G(z) = \left(z^{-}1 - \frac{z^{-}3}{3!} + \frac{z^{-}5}{5!} - \frac{z^{-}7}{7!} + ...\right)(1 + 3z^{-}2 + 2z^{-}4) \tag{0.0.4}$$

Definition 1. *The z-transform of a function is defined as*

$$g[n] \overset{\mathcal{Z}}{\rightleftharpoons} G(z) \tag{0.0.5}$$

$$G(z) = \sum_{n=-\infty}^{\infty} g[n] z^{-n} \tag{0.0.6}$$

So,

$$G(z) = \sum_{n} g[n] \times z^{-n} \tag{0.0.7}$$

g[11] is simply the coefficient in front of $z^{-}11$ in this power series expansion of $G(z)$:

$$g[11] = -\frac{1}{11!} + \frac{3}{9!} - \frac{2}{11!} \tag{0.0.8}$$