Assignment

EE23BTECH11008 - Meenakshi

Q:The difference between any two cosecutive interior angles of a polygon is 5°.If the smallest angle is 120°,find the number of sides of polygon.
Solution: The interior angles of a polygon are in AP with $x(0) = 120$, $d = 5$ The sum of n terms of

Variable	Description	Value
$x(0)$	first term of AP	120
d	common difference of AP	5
$x(n)$	general term of AP	none
n	Describing the order of term	none
$u(n)$	unit step function	mentioned above
$U(z)$	z-transform of u(n)	$\frac{1}{1-z^{-1}}$
$X(z)$	z-transform of x(n)	$x(0)U(z) + d\left(-z\frac{d(U(z))}{dz}\right)$

Fig. 0: Plot of the general term taken from Python

an AP is given by

$$S = \frac{n}{2}(2 \cdot x(0) + (n-1)d) \tag{1}$$

Sum of interior angles of AP is given by

$$S = (n-2)180 \tag{2}$$

$$\frac{n}{2}(2 \cdot x(0) + (n-1)d) = (n-2)180 \tag{3}$$

$$\frac{n}{2}(240 + (n-1)5) = (n-2)180 \tag{4}$$

$$n(235 + 5n) = 360n - 720 \tag{5}$$

$$5n^2 + 235n = 360n - 720 \tag{6}$$

$$5n^2 - 125 + 720 = 0 \tag{7}$$

$$n^2 - 25n + 144 = 0 \tag{8}$$

solving the above equation we get

$$n = 16, 9 \tag{9}$$

$$\boxed{x(n) = (120 - 5n) \times u(n)} \tag{10}$$

The expression for u(n) is

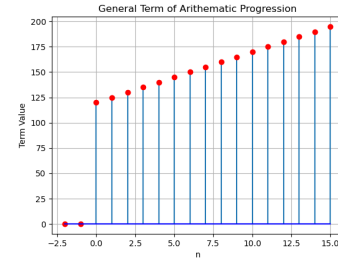$$u(n) = \begin{cases} 1 & \text{if } n \geq 0, \\ 0 & \text{if } n < 0. \end{cases}$$

On Z-transformation

$$U(z) = \sum_{n=-\infty}^{\infty} z^{-n}u(n)$$

$$U(z) = \sum_{n=0}^{\infty} z^{-n}$$

$$\frac{d(U(z))}{dz} = \sum_{n=0}^{\infty} -nz^{-n-1}$$

Now,

$$X(z) = \sum_{n=-\infty}^{\infty} (x(0) + nd)z^{-n}u(n)$$

$$X(z) = x(0)U(z) + d\left(-z\frac{d(U(z))}{dz}\right)$$

$$X(z) = 120U(z) + 5\left(-z\frac{d(U(z))}{dz}\right)$$

$$X(z) = \frac{120}{1 - z^{-1}} + \frac{5z^{-1}}{(1 - z^{-1})^2} \quad \text{ROC: } |z| > 1$$

$$\boxed{X(z) = 120U(z) - 5z\frac{d(U(z))}{dz}} \tag{11}$$