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:

Variable	Description	Value
$x(0)$	first term of AP	120
d	common difference of AP	5
$x(n)$	general term of AP	none

TABLE 0: input parameters

Sum of interior angles of a polygon with $n + 1$ sides is given by

$$S = (n - 1)180 \tag{1}$$

Sum of n terms of AP is given by

$$y(n) = \sum_{k=0}^{n} x(k) \tag{2}$$

$$= x(n) * u(n) \tag{3}$$

$$x(n) * u(n) = (n - 1)180 \tag{4}$$

$$Y(z) = X(z)U(z) \tag{5}$$

$$= \left(\frac{x(0)}{1 - z^{-1}} + \frac{dz^{-1}}{(1 - z^{-1})^2} \right) \cdot \frac{1}{1 - z^{-1}} \quad |z| > 1 \tag{6}$$

$$= \frac{120}{(1 - z^{-1})^2} + \frac{5z^{-1}}{(1 - z^{-1})^3} \quad |z| > 1 \tag{7}$$

$$= \frac{120}{1 - z^{-1}} + \frac{125z^{-1}}{1 - z^{-1}} + \frac{130z^{-2}}{(1 - z^{-1})^2} + \frac{5z^{-3}}{(1 - z^{-1})^3} \tag{8}$$

applying inverse Z-transform for each term and solving we get,

$$\tag{9}$$

$$y(n) = 120u(n) + 125u(n - 1) + 130(n - 1)u(n - 1) \tag{10}$$

$$+ 5\frac{(n - 1)(n - 2)}{2}u(n - 1) \tag{11}$$

$$= \frac{n + 1}{2}(240 + 5n)u(n) \tag{12}$$

now from (4)

$$y(n) = (n - 1)180 \tag{13}$$

$$\frac{n + 1}{2}(240 + 5n)u(n) = (n - 1)180 \tag{14}$$

$$\tag{15}$$

now replace n by n-1:

$$n(235 + 5n) = (n - 2)360 \tag{16}$$
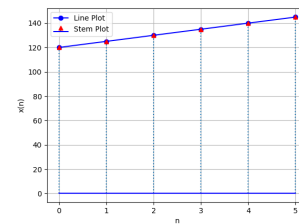
$$5n^2 - 125n + 720 = 0 \tag{17}$$

$$n = 16, 9 \tag{18}$$

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