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 $x(0) = 120$, $d = 5$ Sum of interior angles

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

of AP is given by

$$S = (n-2)180 \tag{1}$$

Sum of n terms of AP is given by

$$y(n-1) = \sum_{k=0}^{n-1} x(k) \tag{2}$$

$$= x(n-1) * u(n-1) \tag{3}$$

$$x(n-1) * u(n-1) = (n-2)180 \tag{4}$$

now taking Z-tansform on both sides

$$X(z)U(z) = \sum_{n=-\infty}^{\infty} (180n - 360)z^{-n}u(n) \tag{5}$$

$$\left(\frac{x(0)}{1-z^{-1}} + \frac{dz^{-1}}{(1-z^{-1})^2}\right)\cdot\frac{1}{1-z^{-1}} \quad |z| > 1 = \sum_{n=0}^{\infty}(180n-360)z^{-n} \tag{6}$$

$$\frac{120}{(1-z^{-1})^2} + \frac{5z^{-1}}{(1-z^{-1})^3} = \frac{180}{1-z^{-1}} - \frac{360z^{-1}}{(1-z^{-1})^2} \quad |z| > 1 \tag{7}$$

$$120\left[\frac{1}{1-z^{-1}} + \frac{z^{-1}}{(1-z^{-1})^2}\right] + \frac{5}{2}\left[-\frac{d}{dz}\left(\frac{1}{1-z^{-1}} + \frac{z^{-1}}{(1-z^{-1})^2}\right)\right] \tag{8}$$

$$= \frac{180}{1-z^{-1}} - \frac{360z^{-1}}{(1-z^{-1})^2} \tag{9}$$

$$120\left[\frac{1}{1-z^{-1}} + \frac{z^{-1}}{(1-z^{-1})^2}\right] + \frac{5}{2}\left[-\frac{d}{dz}\left(\frac{1}{1-z^{-1}} + \frac{z^{-1}}{(1-z^{-1})^2}\right)\right] \tag{10}$$

$$-\frac{180}{1-z^{-1}} + \frac{360z^{-1}}{(1-z^{-1})^2} = 0 \tag{11}$$

Taking inverse Z- transform on both sides

$$\left(120(n) + \frac{5}{2}n(n-1)\right)u[n-1] - 180nu[n-1] + 360u[n] = 0 \tag{12}$$

$$\frac{n}{2}(235 + 5n)\,u[n-1] - 180nu[n-1] + 360u[n] = 0 \tag{13}$$

$$n(235 + 5n) - 360n + 720 = 0 \forall n \geq 1 \tag{14}$$

$$5n^2 - 125 + 720 = 0 \tag{15}$$

solving the above equation we get

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

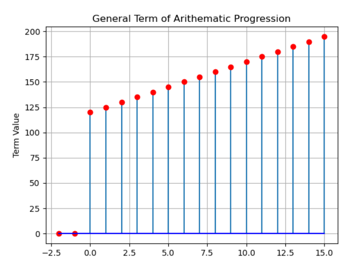

Fig. 0: Plot of the general term taken from Python