

Maths Assignment

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PROBLEM STATEMENT

A G.P consists of an even number of terms. If the sum of all terms is 5 times the sum of terms occupying odd places, then find its common ratio.

X,Y,X_o,Y_o are frequency counterparts of the above GP

$$X(z) = \frac{x(0)}{1 - rz^{-1}} \quad |z| > |r| \quad (9)$$

$$X_o(z) = \frac{x(0)}{1 - r^2 z^{-1}} \quad (10)$$

$$Y(z) = \frac{x(0)}{(1 - rz^{-1})(1 - z^{-1})} \quad (11)$$

$$Y_o(z) = \frac{x(0)}{(1 - rz^{-\frac{1}{2}})(1 - z^{-1})} \quad (12)$$

SOLUTION

Parameter	Description	condition
N	Number of terms in the G.P	-
M	number of odd place terms	$N=2M$
$x(0)$	first term in the G.P	-
r	common ratio in the G.P	-
$x(n)$	$n + 1$ th term in the G.P	$x(n) = x(0)r^n$
$y(n)$	sum of G.P series	$y(n) = x(0)\left(\frac{r^{n+1}-1}{r-1}\right)u(n)$
$x_o(n)$	$n + 1$ th term of G.P of odd places	$x_o(n) = x(0)r^{2n}$
$y_o(n)$	sum of terms in odd places	$y_o(n) = x(0)\left(\frac{r^{n+1}-1}{r^2-1}\right)u(n)$

TABLE I
INPUT PARAMETERS

Solving the Question in time domain:

$$x(n) = x(0)r^n \quad (1)$$

$$y(n) = x(0)\left(\frac{r^{n+1}-1}{r-1}\right)u(n) \quad (2)$$

The sum of terms in odd places:

$$x_o(n) = x(0)r^{2n} \quad (3)$$

$$y_o(n) = x(0)\left(\frac{r^{n+1}-1}{r^2-1}\right)u(n) \quad (4)$$

Then from (2) and (4)

$$x(0)\left(\frac{r^N-1}{r-1}\right)u(n) = 5\left(x(0)\left(\frac{r^{2M}-1}{r^2-1}\right)u(n)\right) \quad (5)$$

$$\frac{r^2-1}{r-1} = 5 \quad (6)$$

$$\text{as } r \neq 1, \quad \text{hence } r = 4 \quad (7)$$

$$(8)$$