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.

Solution

Parameter	Description
n	Number of terms in the G.P
$x(0)$	first term in the G.P
r	common ratio in the G.P
$x(n)$	nth term in the G.P
$y(n)$	sum of G.P series
$y_o(n)$	sum of terms in odd places

TABLE I
Input Parameters

Solving the Question in time domain:

$$x(n) = x(0)r^n \tag{1}$$

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

$$Y(z) = \frac{x(0)}{(1-rz^{-1})(1-z^{-1})} \tag{3}$$

The sum of terms in odd places:

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

$$n' = \frac{n-1}{2} \tag{5}$$

$$w(n) = x(0)\left(\frac{r^{n+1}-1}{r^2-1}\right)u(n) \tag{6}$$

where $r \neq \pm 1$

$$W(z) = \frac{x(0)}{\left(1-rz^{\frac{-1}{2}}\right)(1-z^{-1})} \tag{7}$$

Then from (2) and (6)

$$x(0)\left(\frac{r^{n+1}-1}{r-1}\right)u(n) = 5x(0)\left(\frac{r^{n+1}-1}{r^2-1}\right)u(n) \tag{8}$$

$$r^2 - 5r + 4 = 0 \tag{9}$$

$$r = 4 \tag{10}$$