Math Modeling

Orthogonality Condition

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1. Statement of Problem

Prove the orthogonality condition of a Discrete Time Fourier Series (DTFS)

Eq. 1

1. Solution of Problem

The proof of the above statement is obvious if you represent the equation 1 as the sum of a finite geometric series. The sum of a finite geometric series can be seen in equation 2.

=

Eq. 2

For this example, the representation of r can be seen in equation 3.

r=

Eq. 3

and,

=1

Eq. 4

**If J = M**

So, if j and m were to equal the same integer value, than the series would simply be the sum from k =1 to n of 1. This is shown below as Eq. 5.

= n

Eq. 5

**If J≠M**

If J is not equal to M the value will always be zero. This can be easily seen by looking at equation 6.

= = 0

Eq. 6