Echoes
Little bit that I understand !

Cross-correlation property of ZC sequence

Posted on July 19, 2015 by admin

Another important property of ZC sequence is its circular cross-correlation property. It can be stated as follows:

"The absolute value of the cyclic cross-correlation function between any two ZC sequences is constant and equal to 1/sqrt(N_ZC), if |u1-u2| is relatively prime with respect to N_ZC."

Where, u1, and u2 are root indices and N_ZC is sequence length.

Here is small octave script I wrote to illustrate this property.

```octave
% Property 2 :
% The cross-correlation between two prime length Zadoff-Chu
% sequences,% i.e. different values of u, u=u_1, u=u_2 ,
% is constant 1/sqrt(N_ZC),
% Provided that u_1 - u_2 is relative prime to N_ZC

clear all;
close all;
root = 25;
seq_length = 63;

% Generate ZC sequence with root = 25
for n= 0:seq_length-1
    zc_seq25(n+1) = exp((-j*pi*root*n*(n+1)/seq_length));
end

root = 29;
% Generate ZC sequence with root = 29
for n= 0:seq_length-1
    zc_seq29(n+1) = exp((-j*pi*root*n*(n+1)/seq_length));
end

root = 34;
% Generate ZC sequence with root = 34
for n= 0:seq_length-1
    zc_seq34(n+1) = exp((-j*pi*root*n*(n+1)/seq_length));
end

% cross correlation between zc_seq25 and zc_seq29
norm_a=norm(zc_seq25);
norm_b=norm(zc_seq29);
zc_seq25=zc_seq25/norm_a;
zc_seq29=zc_seq29/norm_b;
for ii=1:length(zc_seq29)
    corr(ii)=zc_seq25*zc_seq29';
    zc_seq29=[zc_seq29(end),zc_seq29(1:end-1)];
end
plot(abs(corr),"1");
hold on;

% cross correlation between zc_seq25 and zc_seq34
norm_a=norm(zc_seq25);
norm_c=norm(zc_seq34);
zc_seq25=zc_seq25/norm_a;
```

```
zc_seq34=zc_seq34/norm_c;
for ii=1:length(zc_seq34)
    corr(ii)=zc_seq25*zc_seq34';
    zc_seq34=[zc_seq34(end),zc_seq34(1:end-1)];
end
plot(abs(corr),"2");
```

Below given is output and following two observations can be made.

1. It can be seen that when |u1-u2| = |25-29| = 5 is relatively prime to sequence length (63), the absolute value of the output is constant 1/sqrt(63) = 0.12599. This is shown in red plot of the output.

2. It can be seen that when |u1-u2| = |25-34| = 9 is not relatively prime to sequence length (63), the absolute value of the output is not constant. This is shown in green plot of the output.

Cross correlation property of ZC sequence
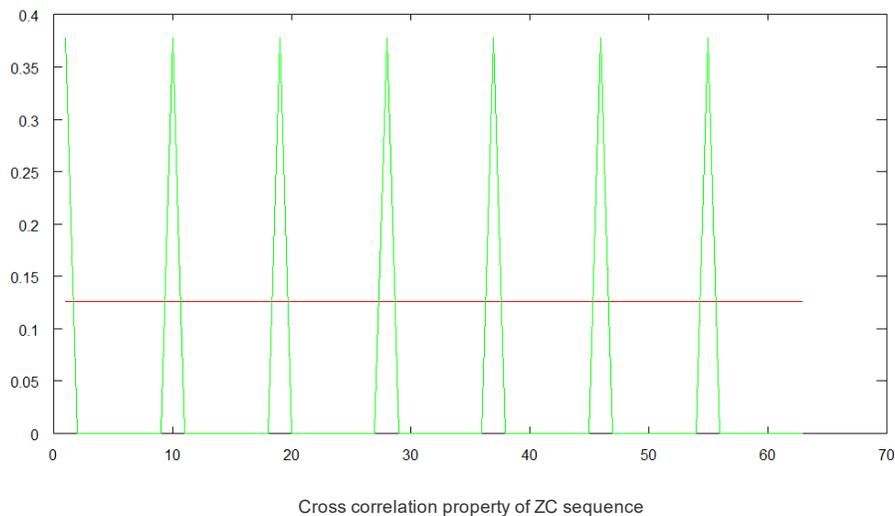
~~ continued in next post.

_Dheeraj

This entry was posted in Uncategorized. Bookmark the permalink.

Echoes
Proudly powered by WordPress.