

# Lab 9

## Task 1

```
syms t ak;

T = 2*pi;
w = (2*pi)/T;
x = sin(t);
ak = CTFS(x, T);
x1 = ICTFS(ak, T);

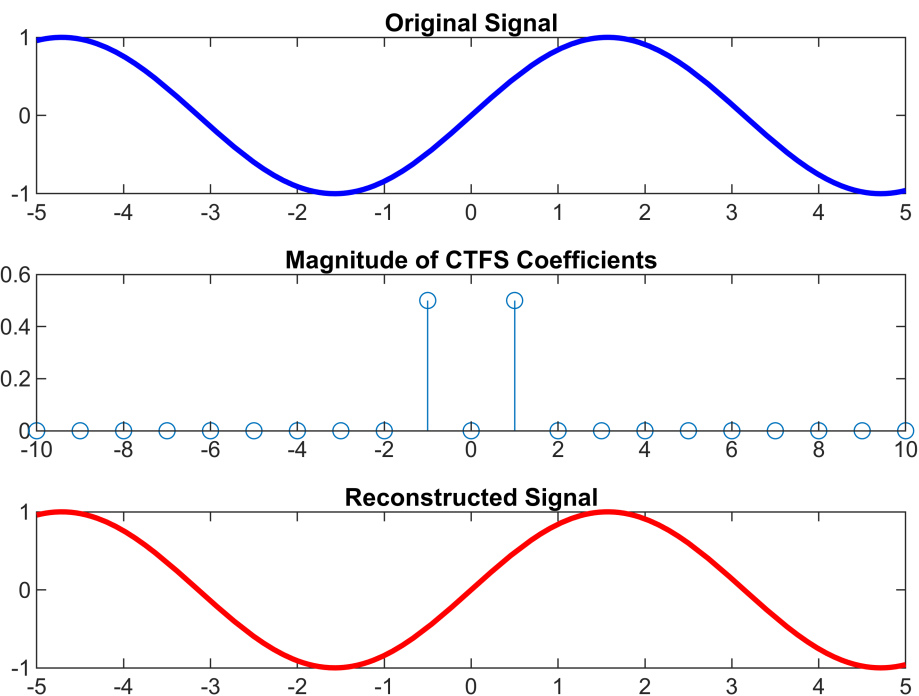
figure;
subplot(3,1,1);
fplot(x, 'blue', 'linewidth', 2);
title('Original Signal');

subplot(3,1,2);
stem(-10:10, abs(ak));
title('Magnitude of CTFS Coefficients');

subplot(3,1,3);
fplot(x1, 'r', 'linewidth', 2);
title('Reconstructed Signal');

sgtitle('Signal Analysis using CTFS');
```

### Signal Analysis using CTFS



## Task 2

```
syms t;

x = sin(pi*t);
T = 2*pi;
k = -10:10;
w = (2*pi)/T;

Dif = diff(x, t);

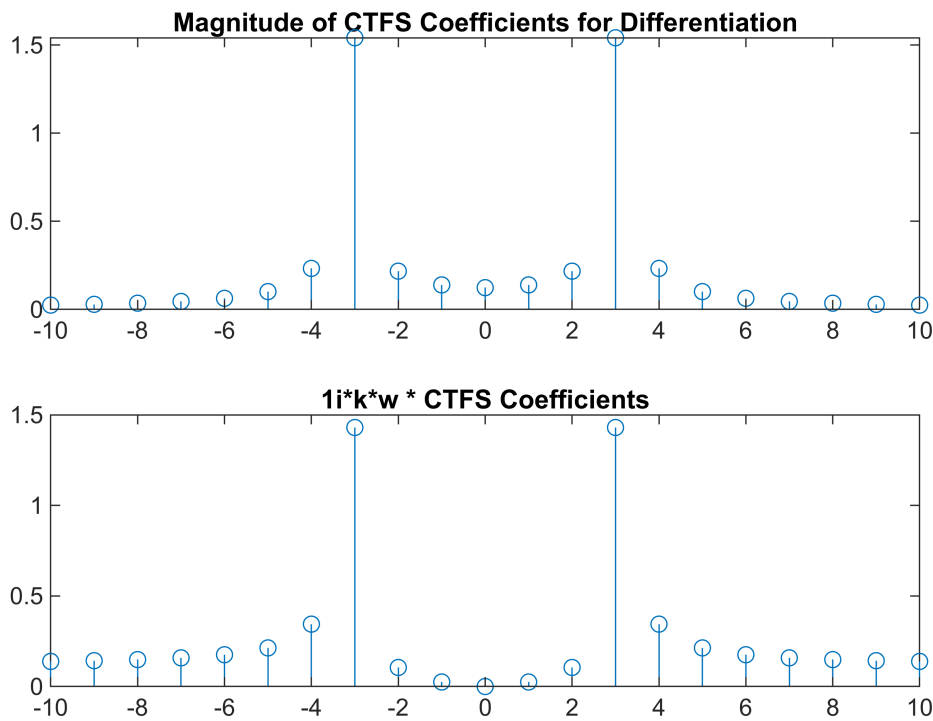
figure;

LHS = CTFS(Dif, T);
subplot(2,1,1);
stem(k, abs(LHS));
title('Magnitude of CTFS Coefficients for Differentiation');

ak = CTFS(x, T);
RHS = (1i*k*w .* ak);
subplot(2,1,2);
stem(k, abs(RHS));
title('1i*k*w * CTFS Coefficients');

sgtitle('Comparison of Differentiation and Frequency Modulation in CTFS');
```

### Comparison of Differentiation and Frequency Modulation in CTFS



### Function 1

```
function ak = CTFS(x, T)
    syms t;
    w = (2*pi)/T;

    ak = zeros(1, 21); % Initializing ak to zeros

    for k = -10:10
        ak(k+11) = (1/T) * int(x * exp(-1i*k*w*t), t, 0, T);
    end
end
```

### Function 2

```
function x = ICTFS(ak, T)
    syms t;
    w = (2*pi)/T;

    x = 0;
    for k = -10:10
        x = x + ak(k+11) * exp(1j*k*w*t);
    end
end
```