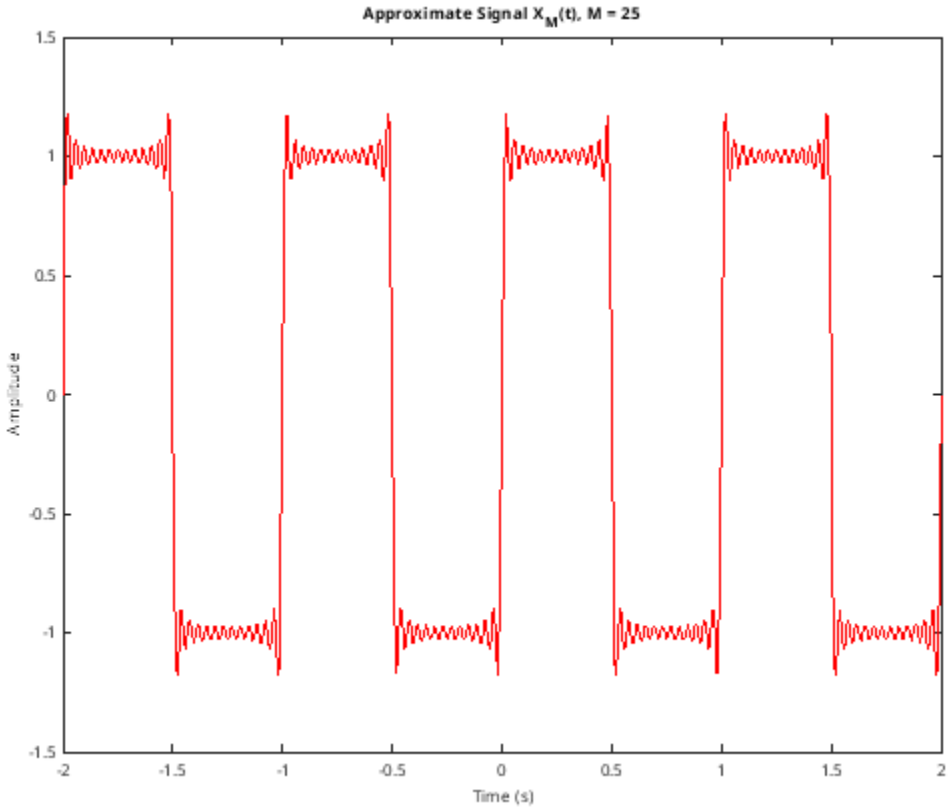
Table of Contents


```
clear all;
```

Part a: Plot approximate signal

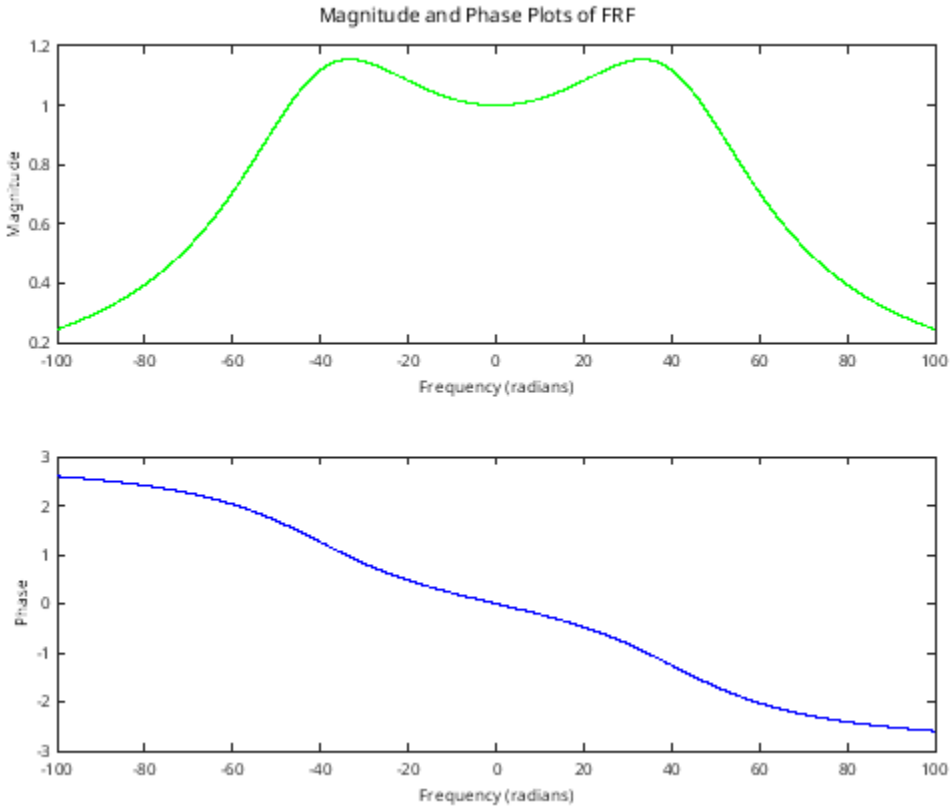
```
figure(1)
M = 25;
w_0 = 2 .* pi;
k = -M:M;
t = linspace(-2, 2, 1000);

a_k = @(k) (1 ./ (1j .* pi .* k)) .* (1 - (-1).^k);

aK = arrayfun(a_k, k);
aK(ceil(length(aK)/2)) = 0;

E = exp(1j * w_0 * (k.'* t));
x_t = real(aK * E);

plot(t, x_t, 'r', 'LineWidth',2);
xlabel("Time (s)");
ylabel("Amplitude");
title("Approximate Signal X_{M}(t), M = 25");
```



Part b: Plot magnitude and phase of FRF

```
figure(2)
w_n = 15 .* pi;
alpha = (w_n).^2;
zeta = 0.5;

h = @(w) alpha ./ (-w.^2 + 2 .* 1j .* zeta .* w_n .* w + w_n .^2);

W = linspace(-100, 100, 5000);

H = arrayfun(h, W);

subplot(2,1,1);

plot(W, abs(H), 'g', 'LineWidth', 2);
ylabel('Magnitude');
xlabel('Frequency (radians)')

subplot(2,1,2);
plot(W, angle(H), 'b', 'LineWidth', 2);
ylabel('Phase');
xlabel('Frequency (radians)');
```

```
sgtitle('Magnitude and Phase Plots of FRF');
```

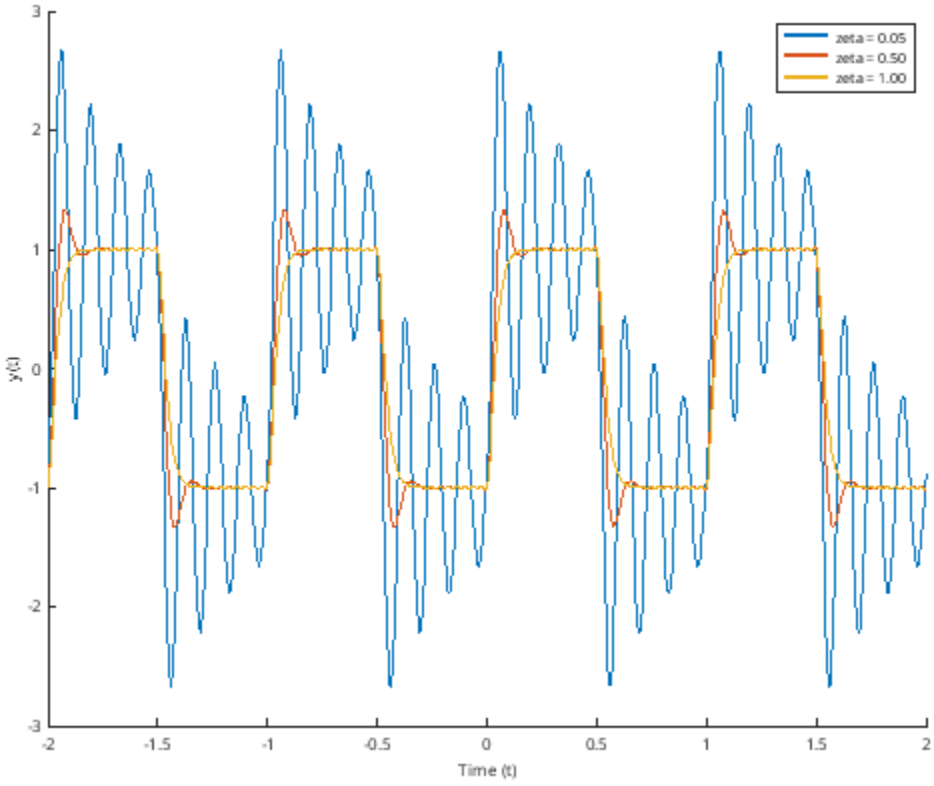


Part c: Evaluate and plot y(t) using the FRF method and x(t) from (a)

y(t) = a_k H(jkw_0) e^(jkw_0t)

```
wk = k * w_0;
zetas = [0.05 0.5 1];

Hjw = @(w, z) alpha ./ (w_n^2 - w.^2 + 1j*2*z*w_n.*w);

figure(3)
hold on

for i = 1:3
    z = zetas(i);

    Hk = Hjw(wk, z);

    bk = Hk .* aK;

    y_t = real(bk * E);
```

```
    plot(t, y_t, 'LineWidth', 2.5, 'DisplayName', sprintf('zeta = %.2f', z));

end
xlabel("Time (t)")
ylabel("y(t)")
legend()
```



Published with MATLAB® R2024b