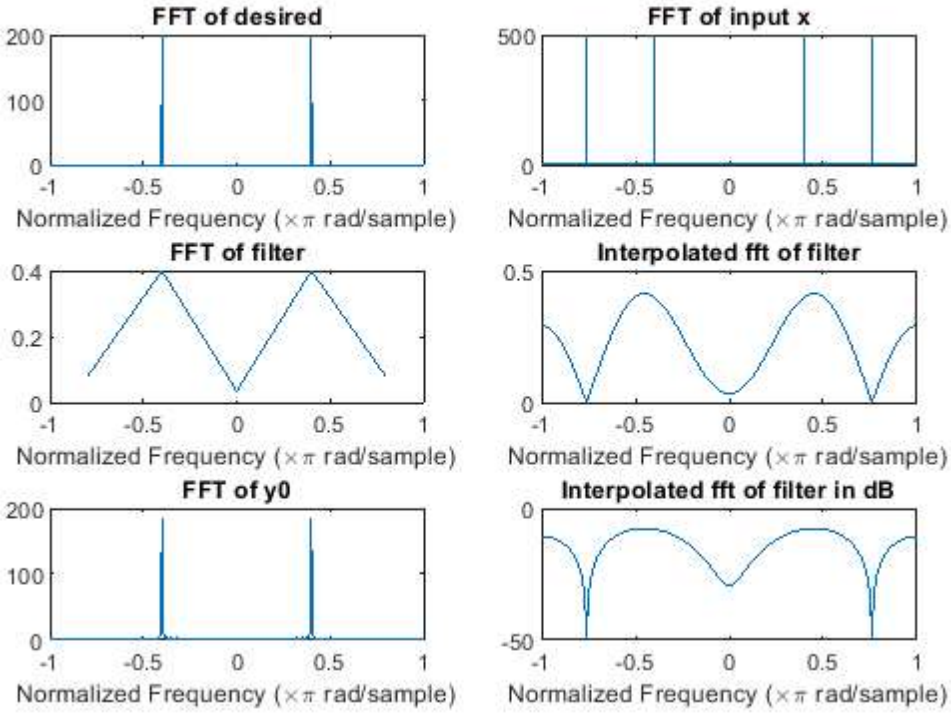
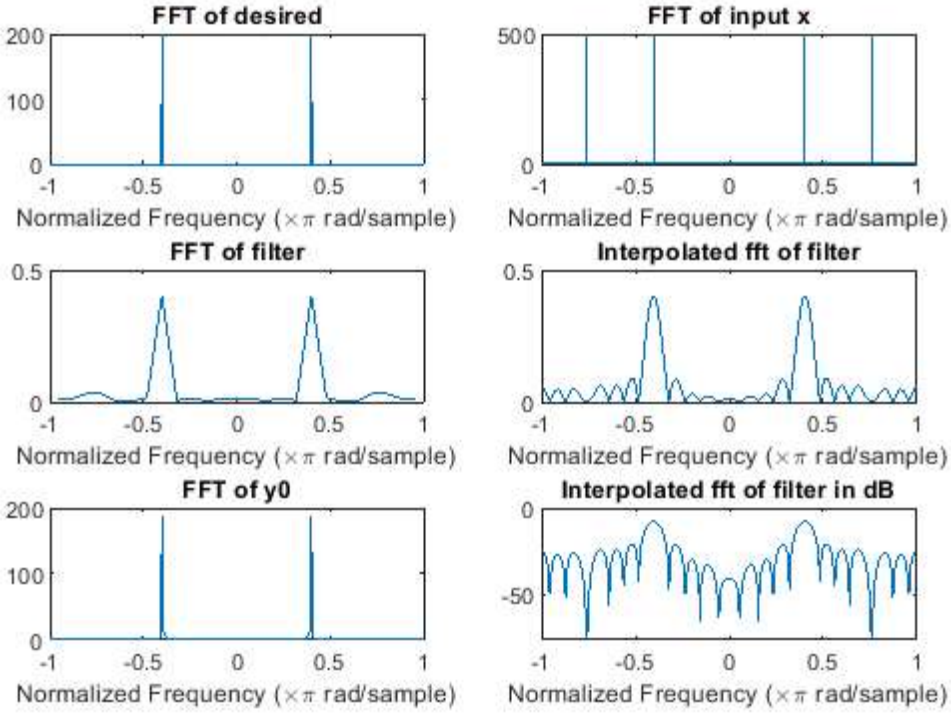
```
close
clear all
clc

MM = [5 25 75];
L = 1000;   % used N in code below instead of L
aa = [0.1 0.5];

for ka = [1 2]
    a = aa(ka);
    xs = cos( 2*pi*0.38*(0:(L-1)))+a*randn(1,L) + cos(2*pi*0.2*(0:(L-1)));  % this is x
    xd = cos(2*pi*0.2*(0:(L-1)) + pi/5)*0.4;   % this is d
    for kM = 1:3
        M = MM(kM);
        R = zeros(M);
        P = zeros(M,1);
        for n = M:L
            xn = xs(n:-1:(n-M+1));  % first element of xn vector is x(n) (current) followed by past inputs
            R = R + xn'*xn;
            P = P + xd(n)*xn';
        end

        ev = eig(R);
        w = inv(R)*P;

        figure((ka-1)*3+kM)
        sgtitle("Prelab 9")
        subplot(3,2,1)
        fv = (0:(L-1)) - floor(L/2);
        fv = 2*fv/L;
        plot(fv, abs(fftshift(fft(xd))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
        title('FFT of desired')

        subplot(3,2,2)
        plot(fv, abs(fftshift(fft(xs))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
        title('FFT of input x')

        subplot(3,2,3)
        fvM = (0:(M-1)) - floor(M/2);
        fvM = 2*fvM/M;
        plot(fvM, abs(fftshift(fft(w))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
        title('FFT of filter')

        subplot(3,2,4)
        fvM0 = (0:(512-1)) - floor(512/2);
        fvM0 = 2*fvM0/512;
        plot(fvM0, abs(fftshift(fft(w,512))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
        title('Interpolated fft of filter')

        y = conv(w,xs);
        subplot(3,2,5)
        fvy = (0:(length(y)-1)) - floor(length(y)/2);
        fvy = 2*fvy/length(y);
        plot(fvy, abs(fftshift(fft(y))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
```

```
        title('FFT of y0')

        subplot(3,2,6)
        plot(fvM0, mag2db( abs(fftshift(fft(w,512)))));
        xlabel('Normalized Frequency (\times\pi rad/sample)')
        title('Interpolated fft of filter in dB')
    end
end
```

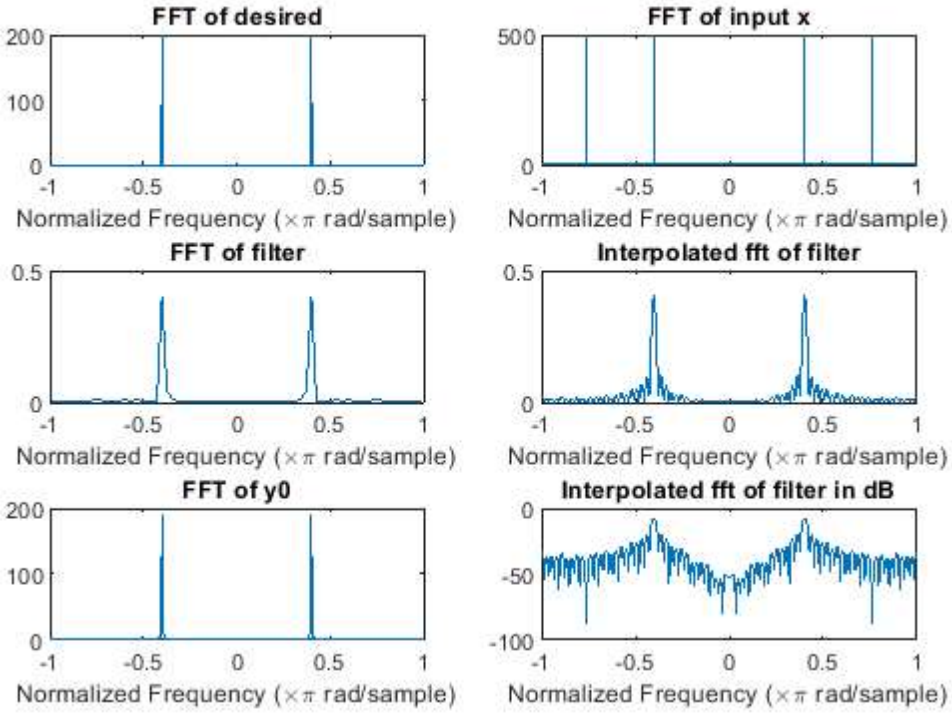
Prelab 9



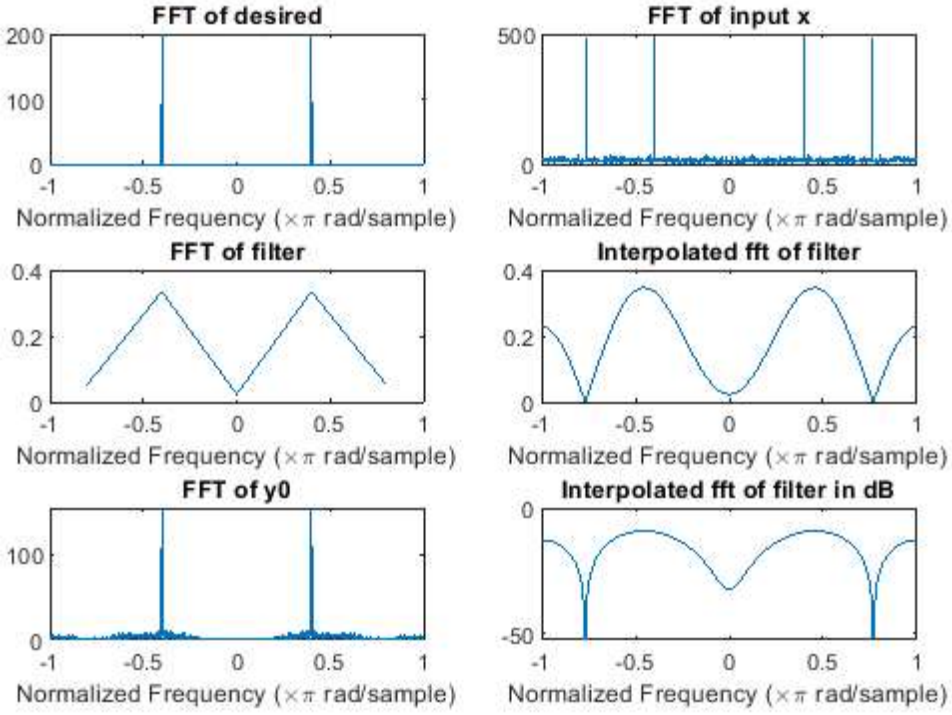
Prelab 9

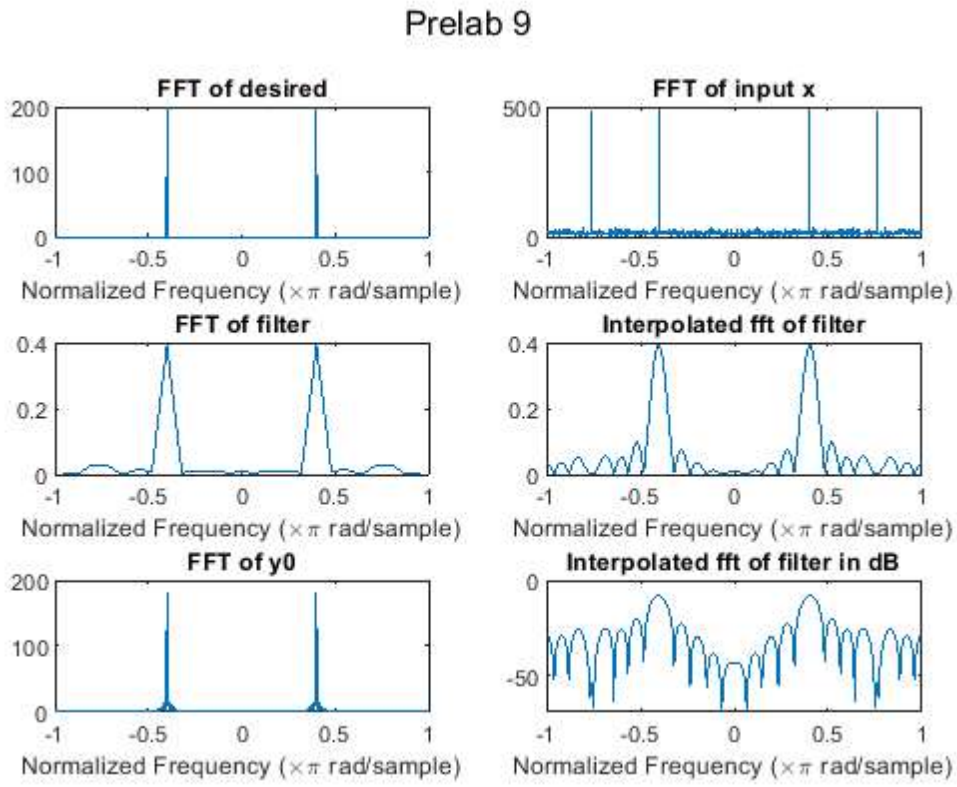


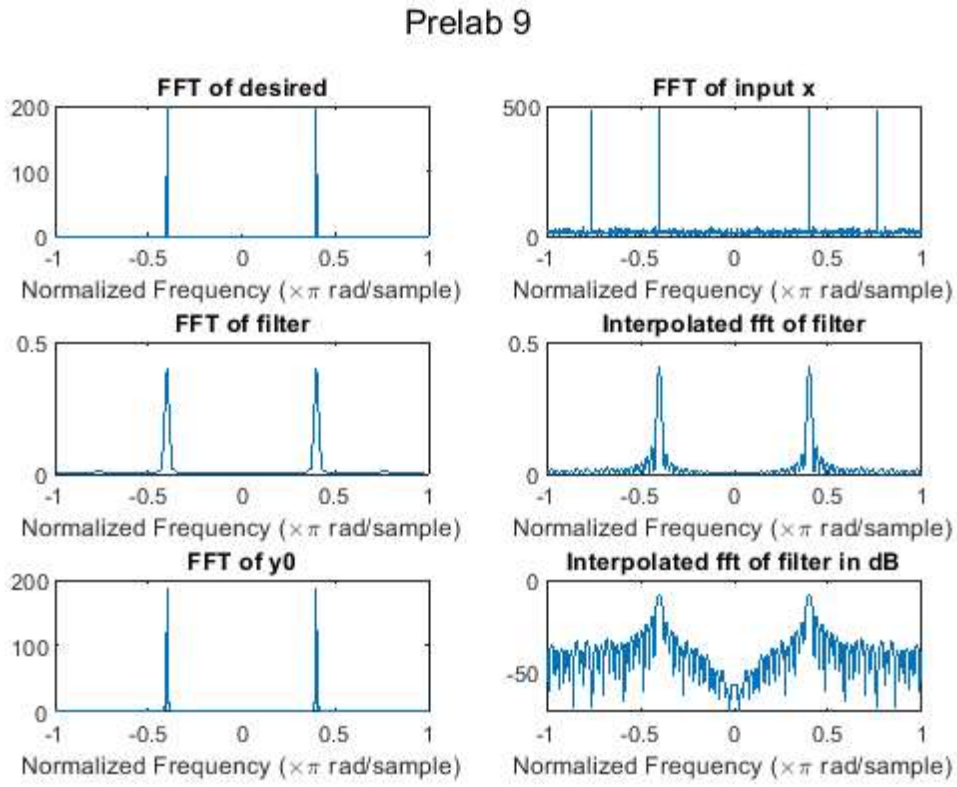
Prelab 9



Prelab 9







Published with MATLAB® R2020a