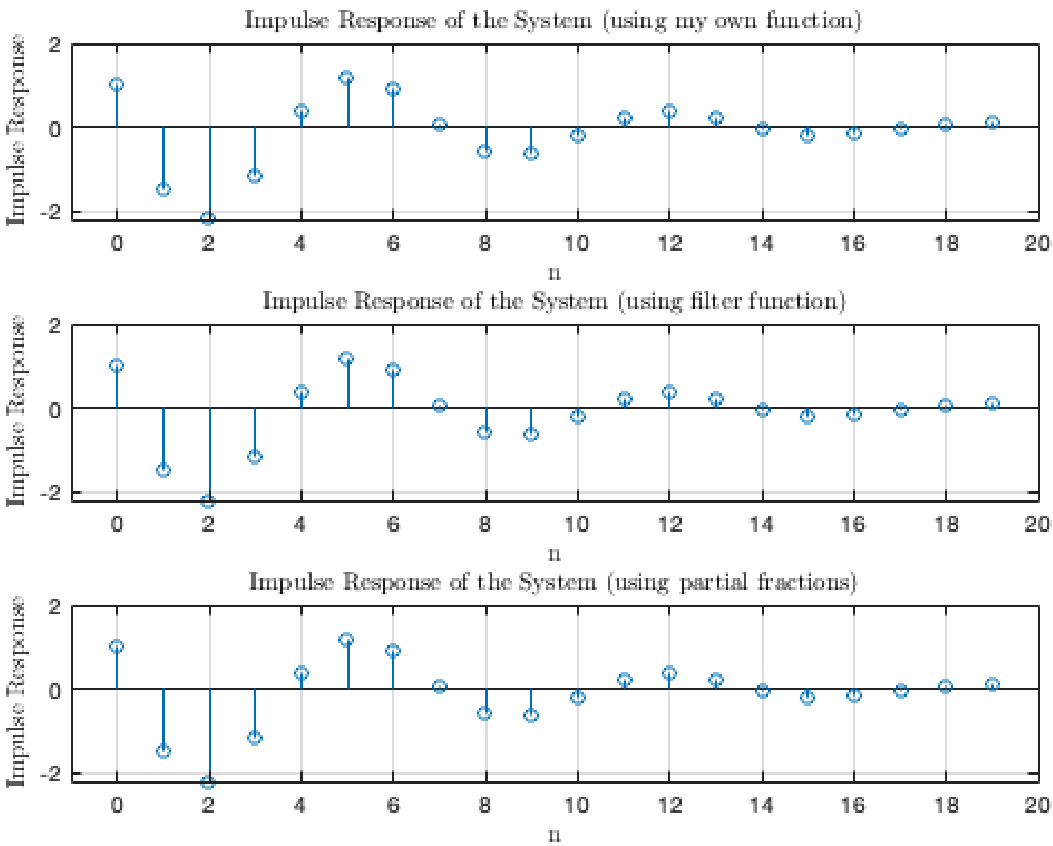
Table of Contents


```
clc; close all; clear;
set(0,'defaultTextInterpreter','latex');

% Note: Functions are placed at the end of the file

% Setting up required functions
del = @(n)double(n==0);
```

Question 1: Trasnfer Function

```
figure;
N = 20;
n = [0:N-1];
impulse = del(n);
numerator_coefficients = [1,-2.5];
denomenator_coefficients = [1,-1,0.7];

% What is the difference equation?
% y(n) = x(n) - 2.5*x(n-1) + y(n-1) - 0.7*y(n-2);

% Findng h[n] using my own function:
subplot(3,1,1);
impulse_response = difference_equation(impulse,N);
impulse_response_length = (0:length(impulse_response)-1);
stem(n,impulse_response);
xlabel('n');
xlim([-1 20]);
ylabel('Impulse Response');
title('Impulse Response of the System (using my own function)');
grid on;

% Findng h[n] using filter function:
subplot(3,1,2);
impulse_response =
 filter(numerator_coefficients,denomenator_coefficients,impulse);
stem(n,impulse_response);
xlabel('n');
xlim([-1 20]);
ylabel('Impulse Response');
title('Impulse Response of the System (using filter function)');
grid on;

% Does it agree with the one computed using your own program?
```

```
% Yes it does!

% Findng h[n] using partial fraction expansion
subplot(3,1,3);
[r,p,k] = residue(numerator_coefficients,denominator_coefficients)
disp('Residues:');
disp(r);
disp('Poles:');
disp(p);
impulse_response = r(1)*p(1).^n + r(2)*p(2).^n;
stem(n, impulse_response);
xlabel('n');
xlim([-1 20]);
ylabel('Impulse Response');
title('Impulse Response of the System (using partial fractions)');
grid on;
```



Question 2

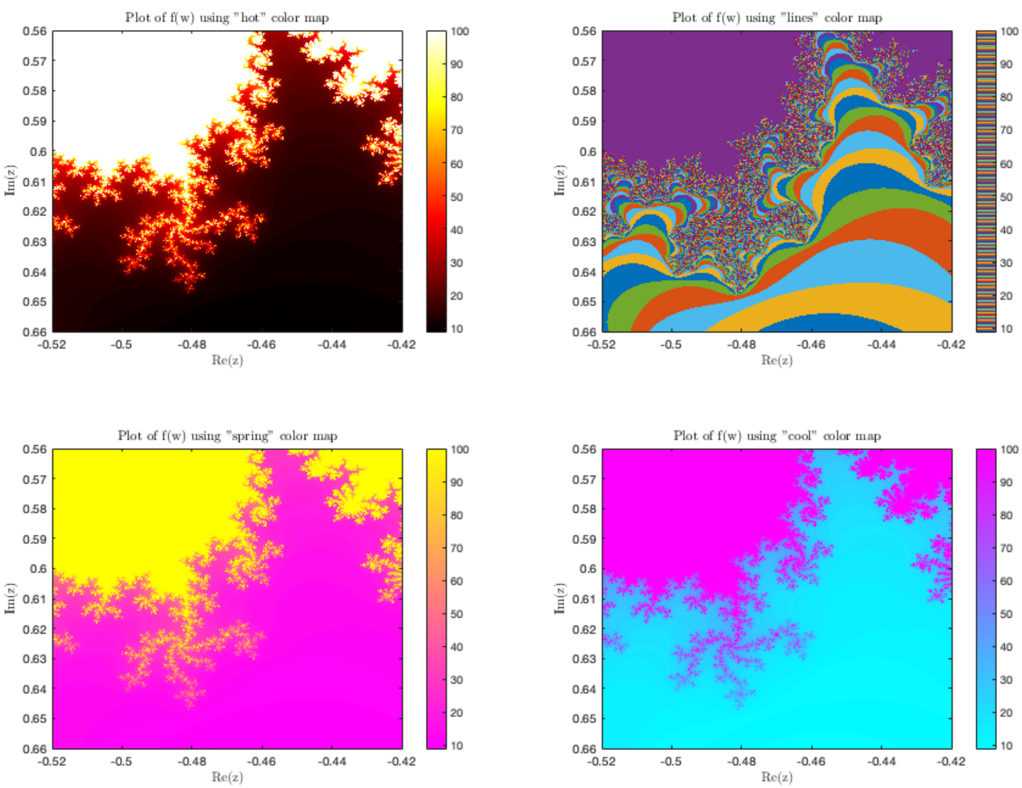
```
a = -0.52;
b = 0.56;
L = 0.1;
step_size = 0.0001
```

```
real_range = [a:step_size:a+L];
imaginary_range = [b:step_size:b+L];
[real, imaginary] = meshgrid(real_range, imaginary_range);
W = complex(real, imaginary);

f = zeros(size(W));

for r = 1:length(W)
    for c = 1:length(W(:,r))
            zn = 0;
            for i = 1:100
                zn = zn*zn + W(r,c);
                f(r,c) = i;
                if(abs(zn)>2)
                    break;
                end
            end
    end
end

figure1=figure('Position', [100, 100, 1024, 1200]);

% hot color map
subplot(2,2,1);
imagesc(real_range, imaginary_range, f);
colormap(subplot(2,2,1),hot);
colorbar;
xlabel('Re(z)');
ylabel('Im(z)');
title('Plot of f(w) using "hot" color map');
xlim([a, a + L]);
ylim([b, b + L]);

% lines color map
subplot(2,2,2);
imagesc(real_range, imaginary_range, f);
colormap(subplot(2,2,2),lines);
colorbar;
xlabel('Re(z)');
ylabel('Im(z)');
title('Plot of f(w) using "lines" color map');
xlim([a, a + L]);
ylim([b, b + L]);

% spring color map
subplot(2,2,3);
imagesc(real_range, imaginary_range, f);
colormap(subplot(2,2,3),spring);
colorbar;
xlabel('Re(z)');
ylabel('Im(z)');
title('Plot of f(w) using "spring" color map');
xlim([a, a + L]);
ylim([b, b + L]);
```

```
% cool color map
subplot(2,2,4);
imagesc(real_range, imaginary_range, f);
colormap(subplot(2,2,4),cool);
colorbar;
xlabel('Re(z)');
ylabel('Im(z)');
title('Plot of f(w) using "cool" color map');
xlim([a, a + L]);
ylim([b, b + L]);
```

step_size =

1.0000e-04



Functions

```
% Differnce Function from Question 1
function y = difference_equation(x,N)

    % Initialize the output vector y
    y = zeros(1, N);
```

```
    y(1) = x(1);
    y(2) = x(2)-2.5*x(1)+y(1);
    % Implement the difference equation using a for loop
    for n = 3:N
        y(n) = x(n) - 2.5*x(n-1) + y(n-1) - 0.7*y(n-2);
    end
end
```

```
r =

   0.5000 + 1.4907i
   0.5000 - 1.4907i


p =

   0.5000 + 0.6708i
   0.5000 - 0.6708i


k =

     []

Residues:
   0.5000 + 1.4907i
   0.5000 - 1.4907i

Poles:
   0.5000 + 0.6708i
   0.5000 - 0.6708i
```

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