

- 2.42 Write a MATLAB script that computes and displays the poles, zeros, and DC gain of the following discrete-time system. Is this system stable? Plot the poles and zeros using the FDSP toolbox function *f_pzplot*. Plot the transfer function surface using *f_pzsurf*.

$$H(z) = \frac{2z^5 + 0.25z^4 - 0.8z^3 - 1.4z^2 + 0.6z - 0.9}{z^5 + 0.055z^4 - 0.85z^3 - 0.04z^2 + 0.49z - 0.32}$$

Solution

```
% Problem 2.42

% Initialize

clc
clear
a = [1 0.055 -0.85 -0.04 0.49 -0.32];
b = [2 0.25 -0.8 -1.4 0.6 -0.9];

% Compute poles, zeros, and DC gain

poles = roots(a)
zeros = roots(b)
DC_gain = polyval(b,1)/polyval(a,1)
if max(abs(poles)) < 1
    fprintf ('\nThis system is stable.\n')
else
    fprintf ('\nThis system is unstable.\n')
end

% Pole-zero plot

figure
f_pzplot (b,a,'Poles and Zeros')
f_wait

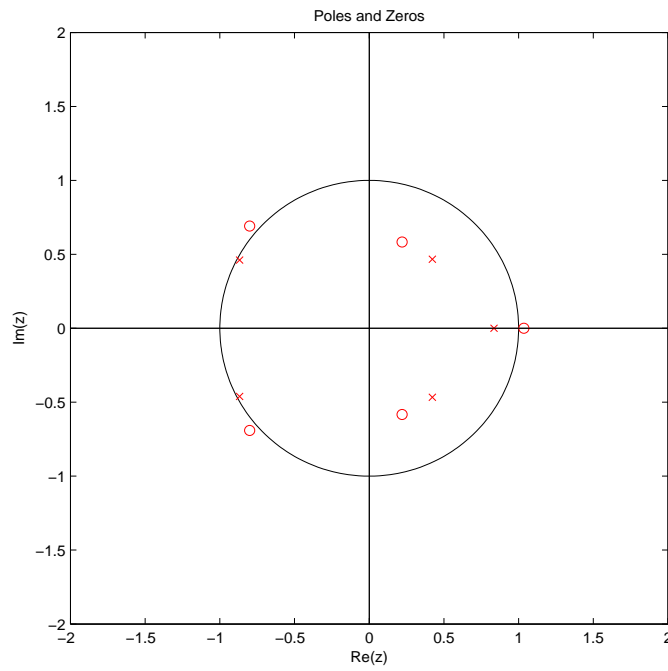
% Transfer function surface

N =61;
hmax = 10;
figure
f_pzsurf (b,a,hmax,N)
pause (0.01) % Fix for Windows XP?
f_pzsurf (b,a,hmax,N)
f_wait
```

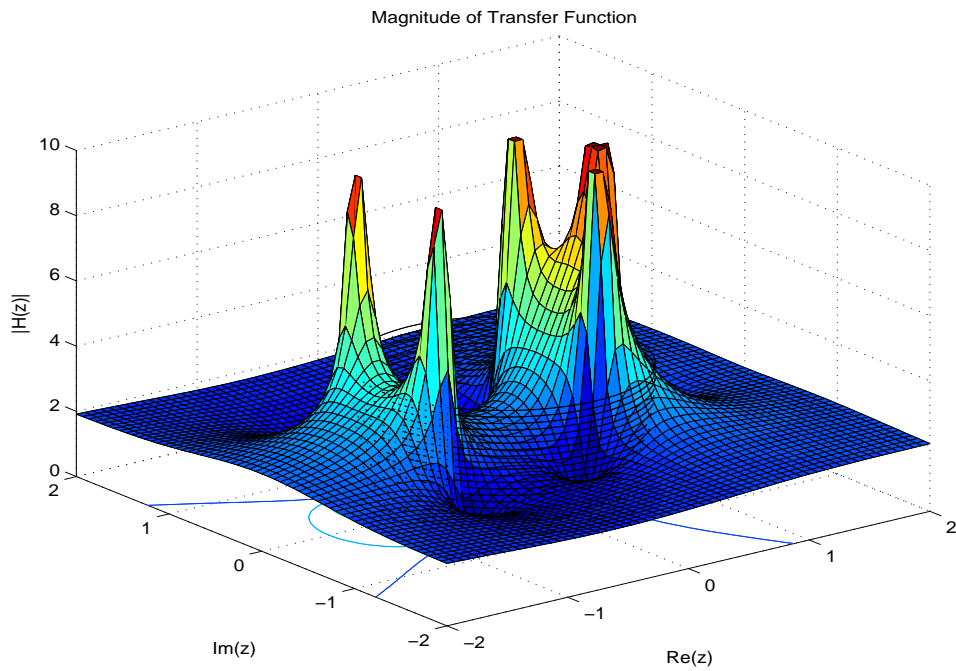
Program output:

```
poles =  
  -0.8681 + 0.4607i  
  -0.8681 - 0.4607i  
   0.8358  
   0.4227 + 0.4667i  
   0.4227 - 0.4667i  
zeros =  
  -0.8004 + 0.6908i  
  -0.8004 - 0.6908i  
   1.0354  
   0.2202 + 0.5833i  
   0.2202 - 0.5833i  
DC_gain =  
  -0.7463
```

This system is stable.



Pole-Zero Plot



Transfer Function Surface