Poles and Zeros

Example

Using MATLAB find the poles and zeros of the network function $H(s)$ and plot the pole-zeros constellation.

$$H(s)=\frac{s^3+4s^2+16s+4}{s^4+20s^3+12s^2+s+10}$$

Solution

The MATLAB function *roots* can be used to obtain the poles and zeros of the network function $H(s)$. The MATLAB *roots* function computes the roots of a polynomial. The general form of the *roots* function is

$$\mathbf{r} = roots(\mathbf{p})$$

where **p** is a vector containing the coefficients of the polynomial in a descending order and **r** is a column vector containing the roots of the polynomial.

For more information write the command *help roots* in the MATLAB command window.

The short MATLAB program for solving this task is

MATLAB Script

```
% Program for poles and zeros
clear; clc;
numerator=[1 4 16 4]; denominator=[1 20 12 1 10];
disp('The zeros are'); z=roots(numerator)
disp('The poles are'); p=roots(denominator)
plot(z,'o'); hold on; plot(p,'rx');
line([0 0],[-4 4]); line([-20 10],[0 0]);
xlabel('Re'); ylabel('Im');
legend('zero','pole');
```

The results obtained from MATLAB are

```
The zeros are

z =

  -1.8667 + 3.3941i
  -1.8667 - 3.3941i
  -0.2666

The poles are

p =

 -19.3822
  -1.0565
   0.2193 + 0.6635i
   0.2193 - 0.6635i
```

The pole-zeros constellation obtained from MATLAB is