Experiment no.1: The Transfer Function

Using Matlab programming in control systems.

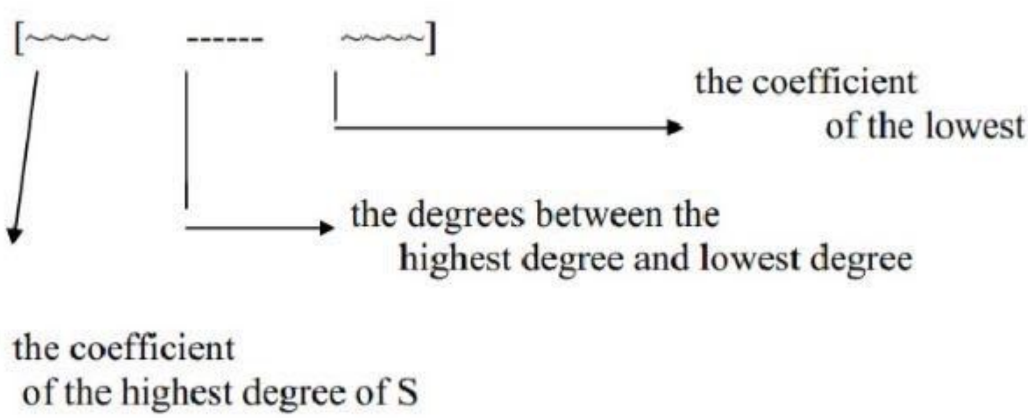
Object :

How to deal with a transfer function and using its coefficients (num , den) in amatlab program.

Instructions :

A) a transfer function such as $G(S)=\frac{18\,(S+20)}{(S+15)(S+25)}$

the numerator of it is =18(S+20),so we enter in it in amatlab program as num=18*[1 20] , where (1) is a coefficient of the S and 20 is a coefficient of S^0 thus the arrangement of coefficient is as follow:



conv: Convolution and polynomial multiplication; for example
C = conv(A, B) .
for example if we have the num=S^3 + 2S^2 +5
so we enter it in a matlab program in the form num=[1 2 0 5] and so on , the same thing is done with denominator so , den=conv[1 15],[1 25] , where conv mean multiply the two brackets with each other.

Example :

If $G(S)= \dfrac{18(S+20)}{(S+15)(S+25)(S+0.4)}$

the program will be as follows:

```
num=18*[1  20];
den=conv ( conv ([1  15],[1  25]),[1  0.4]);
G(s)=tf(num,den)
```

B)if we want to find a T.F. of a 2nd order control system by knowing its natural frequency Wn & damping ratio ζ by a matlab program this could be known as follows:

Program:

```
wn=2; damping=0.707;
[num1 , den1]=ord2(wn , damping);
G1(s)=tf(num1,den1)
```

Case studies

$1 - G(s) = \dfrac{s}{S^2 + 6s + 8}$

$2 - G(s) = \dfrac{(s+3)}{(s+4)(s+2)(s+7)}$

$3 - G(s) = \dfrac{9s}{s^6 + s^4 + s^2 + s}$

$4 - G(s) = \dfrac{s(s+2)}{(s^2+2)(s+5)}$

$5 - damping = 0.4; wn = 2$

$6 - damping = 0.2; wn = 1$