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## Transfer Functions

### Constructing Transfer function using MATLAB tf function

let transfer function,

$$H(S) = \frac{20}{3S^2 + 8S + 20}$$

then,

Numerator = 20

Denominator =  $3S^2 + 8S + 20$

```
num = 20;  
den = [3 8 20];
```

use tf function,

```
H = tf(num,den);  
display(H);
```

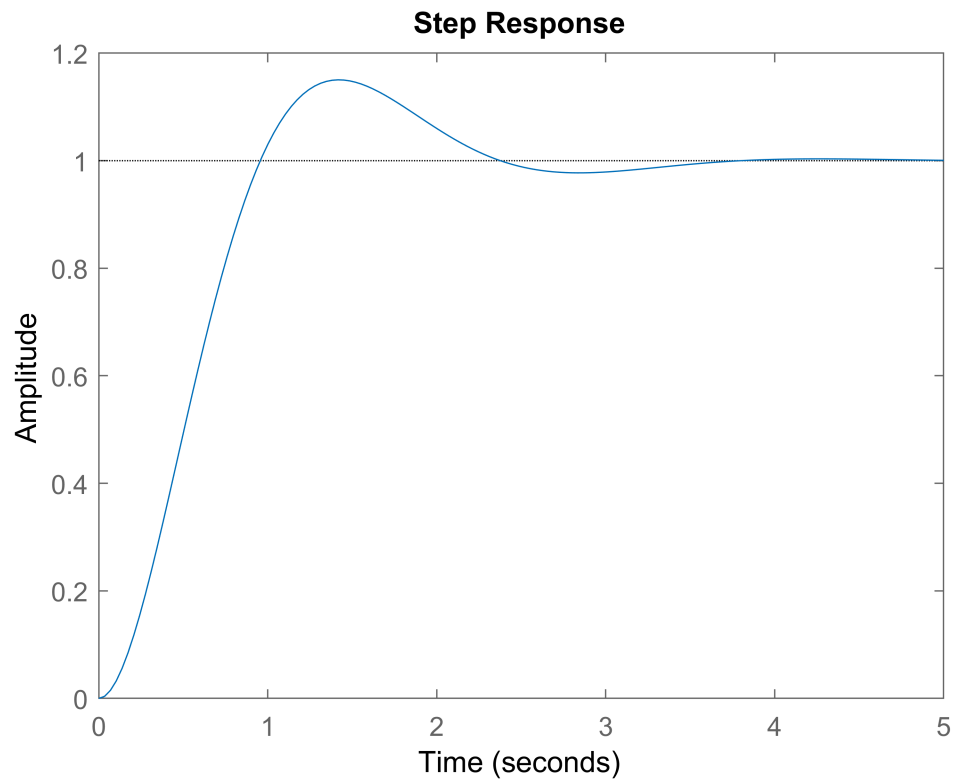
H =

$$\frac{20}{3 s^2 + 8 s + 20}$$

Continuous-time transfer function.

### Plotting the **step response**

```
stepplot(H);
```



### Transfer function translation to factorized form

MATLAB **tf2zp** can be used to transform Transfer function to factored form

$$\text{let } H(S) = \frac{11S^2 + 88S + 165}{S^3 + 9S^2 + 14S},$$

$$H(S) = 11 \left( \frac{1S^2 + 8S + 15}{S^3 + 9S^2 + 14S} \right)$$

$$k = 11$$

$$\text{numerator} = 1S^2 + 8S + 15$$

$$\text{denominator} = S^3 + 9S^2 + 14S$$

```
num1 = [1 8 15];
den1 = [1 9 14 0];
```

Transformation

```
[numZ,denP] = tf2zp(num1,den1);
```

```
display(numZ);
```

```
numZ = 2×1  
-5  
-3
```

```
display(denP);
```

```
denP = 3×1  
0  
-7  
-2
```

Therefore,

$$H(S) = \frac{11(S+5)(S+3)}{S(S+7)(S+2)}$$