EN3143: Electronic Control Systems

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Exercise Number: 1

MATLAB implementation

```
clc;
close all;

num_1 = [2 5 3 6];
den_1 = [1 6 11 6];

[r1,p1,k1] = residue(num_1,den_1)

num_2 = [0 1 2 3];
den_2 = [1 3 3 1];

[r2,p2,k2] = residue(num_2,den_2)
```

Figure 1: MATLAB implementation for Problem 1 and Problem 2

```
r1 =

   -6.0000
   -4.0000
    3.0000


p1 =

   -3.0000
   -2.0000
   -1.0000


k1 =

     2
```

Figure 2: MATLAB implementation results for Problem 1

```
r2 =

    1.0000
    0.0000
    2.0000


p2 =

   -1.0000
   -1.0000
   -1.0000


k2 =

     []
```

Figure 3: MATLAB implementation results for Problem 2

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MATLAB Exercise

(1) $$\frac{N(s)}{D(s)} = \frac{2s^3 + 5s^2 + 3s + 6}{s^3 + 6s^2 + 11s + 6}$$

From MATLAB implementation,

$$r = \begin{bmatrix} -6 \\ -4 \\ 3 \end{bmatrix}, \quad p = \begin{bmatrix} -3 \\ -2 \\ -1 \end{bmatrix}, \quad k = 2$$

$$\therefore \frac{N(s)}{D(s)} = \frac{(-6)}{s+3} + \frac{(-4)}{(s+4)} + \frac{3}{(s+1)} + 2$$

(2) $$\frac{B(s)}{A(s)} = \frac{s^2 + 2s + 3}{s^3 + 3s^2 + 3s + 1}$$

From MATLAB implementation,

$$r = \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}, \quad p = \begin{bmatrix} -1 \\ -1 \\ -1 \end{bmatrix}, \quad k = [\,]$$

$$\therefore \frac{B(s)}{A(s)} = \frac{1}{s+1} + \frac{0}{(s+1)^2} + \frac{2}{(s+1)^3}$$

$$= \frac{1}{s+1} + \frac{2}{(s+1)^3}$$