CONTROL SYSTEMS

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1. What is Transfer Function?
2. Problem
3. Solution
   - Ratio of factors
   - Ratio of Polynomials
4. Code to find zeroes of a transfer function

What is transfer Function

The **transfer function** of a control system is defined as the ratio of the Laplace transform of the output variable to Laplace transform of the input variable assuming all initial conditions to be zero.

$$\implies G(s) = C(s)/R(s)$$

where

$$G(s) \longrightarrow \textit{Transfer function}$$

$$C(s) \longrightarrow \textit{Output of a control system}$$

$$R(s) \longrightarrow \textit{Input of a control system}$$

Question

Transfer function of a system is

$$G(s) = \frac{s^4 + 25s^3 + 20s^2 + 15s + 42}{s^5 + 13s^4 + 9s^3 + 37s^2 + 35s + 50}$$

Find

a. the ratio of factors;
b. the ratio of polynomials .

Solution

a. **The ratio of factors:**

$$G(s) = \frac{(s + 24.2)(s + 1.35)(s^2 - 0.5462s + 1.286)}{(s + 12.5)(s^2 + 1.463s + 1.493)(s^2 - 0.964s + 2.679)}$$

b. **The ratio of polynomials:**

$$G(s) = \frac{s^4 + 25s^3 + 20s^2 + 15s + 42}{s^5 + 13s^4 + 9s^3 + 37s^2 + 35s + 50}$$

Code

Code for Zeroes:

```
import numpy as np
p = np.poly1d([1, 25, 20, 15, 42])
print(p)
rootsp = p.r
print("of Polynomials is :", rootsp)
```

Code for Poles:

```
import numpy as np
p = np.poly1d([1, 13, 9, 37, 35, 50])
print(p)
rootsp = p.r
print("of Polynomials is :", rootsp)
```

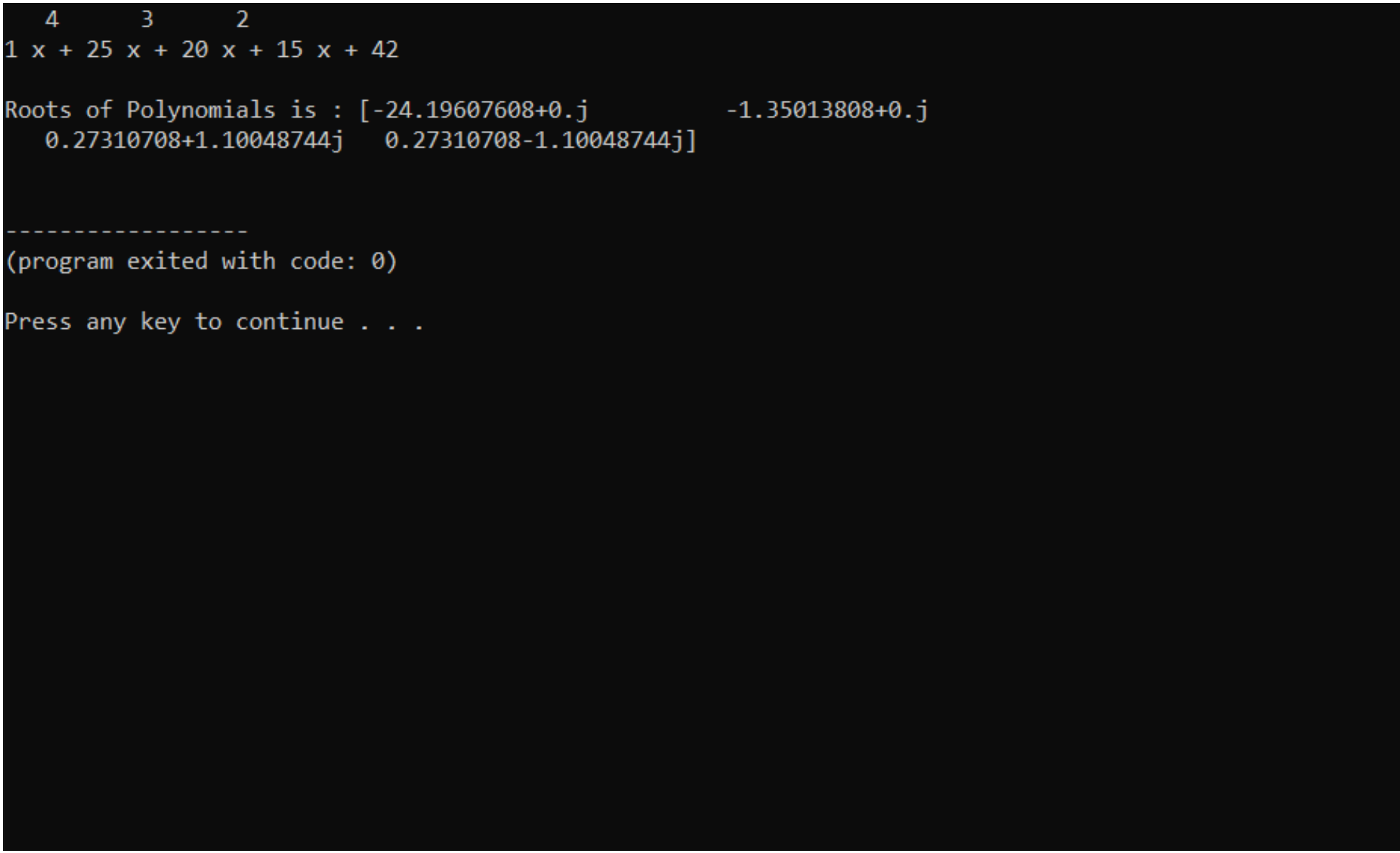

Figure: Zeroes of a transfer function

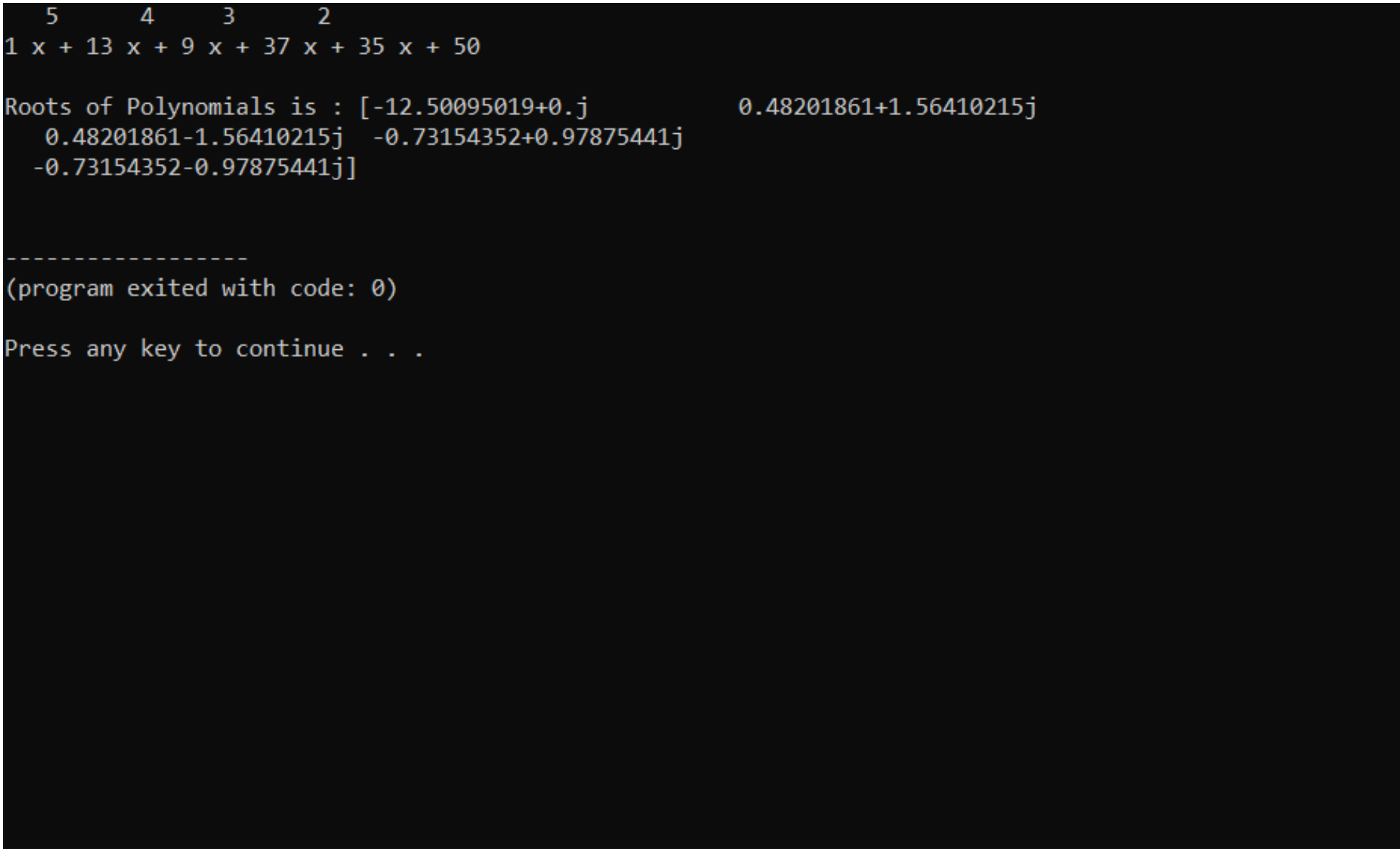

Figure: Poles of a transfer function