Representation of polynomials in MATLAB Since most practical z-transforms are a ratio of polynomials, we start by explaining how MATLAB handles polynomials. In MATLAB polynomials are represented by *row* vectors containing the coefficients of the polynomial in decreasing order. For example, the polynomial

$$B(z) = 1 + 2z^{-1} + 3z^{-3}$$

is entered as `b=[1,2,0,3]`. We stress that even though the coefficient of the z^{-2} term

```
b = [1 2 0 3]
```

```
b = 1×4
     1     2     0     3
```

How to compute the roots of a polynomial?

```
b = [1 1.5 2]
```

```
b = 1×3
    1.0000    1.5000    2.0000
```

```
z = roots(b)
```

```
z = 2×1 complex
  -0.7500 + 1.1990i
  -0.7500 - 1.1990i
```

Example 3.10 Partial fraction expansion using `residuez`

The following expansion:

$$X(z) = \frac{6 - 10z^{-1} + 2z^{-2}}{1 - 3z^{-1} + 2z^{-2}} = 1 + \frac{2}{1 - z^{-1}} + \frac{3}{1 - 2z^{-1}}, \tag{3.45}$$

is obtained by calling `residuez` with `b=[6,-10,2]` and `a=[1,-3,2]`. The reverse operation can be done using the same function as: `[b,a]=residuez(A,p,C)`.

```
b = [ 6 -10  2]
```

```
b = 1×3
     6   -10     2
```

```
a = [ 1  -3  2]
```

```
a = 1×3
     1    -3     2
```

```
% Partial fraction expansion using residuez
[A,p,C] = residuez(b, a)
```

```
A = 2×1
     3
     2
p = 2×1
     2
     1
C = 1
```

```
% Reverse operation
[b, a] = residuez(A, p, C)
```

```
b = 1×3
     6   -10     2
a = 1×3
     1    -3     2
```