Control Systems Lab Report

Your Name

October 1, 2024

1 Introduction

This lab report summarizes various MATLAB functions used in control systems analysis and design. Each function plays a significant role in handling polynomials, transfer functions, and system responses.

2 MATLAB Functions

2.1 roots

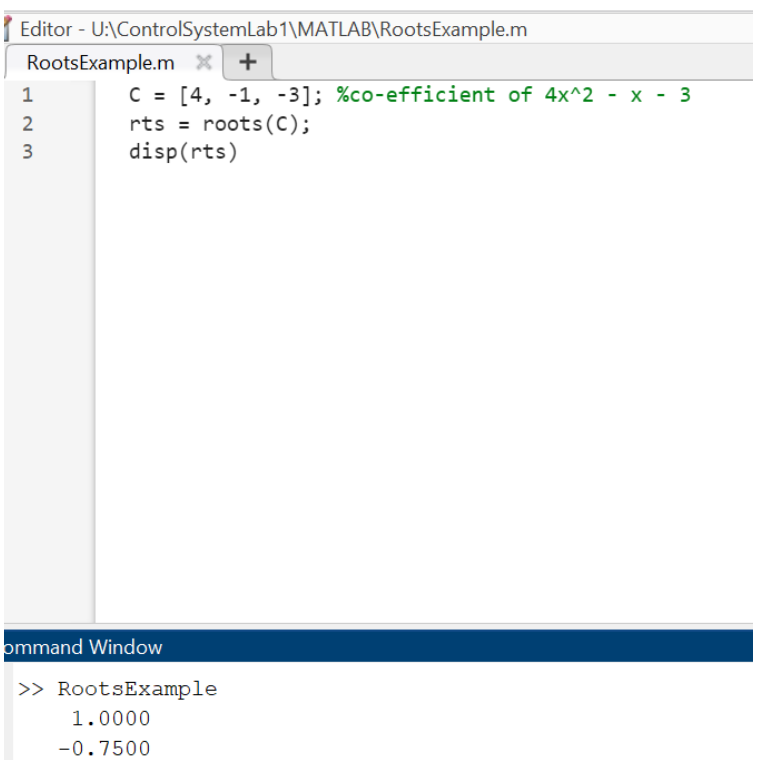

Figure 1: Function: `roots`

The `roots` function finds the roots of a polynomial given its coefficients. It is useful for determining the stability of control systems.

2.2 poly

The `poly` function generates a polynomial with specified roots. This is useful for constructing system transfer functions from desired pole locations.

```
>> help roots
 roots  Find polynomial roots.
    roots(C) computes the roots of the polynomial whose coefficients
    are the elements of the vector C. If C has N+1 components,
    the polynomial is C(1)*X^N + ... + C(N)*X + C(N+1).

    Note:  Leading zeros in C are discarded first.  Then, leading relative
    zeros are removed as well.  That is, if division by the leading
    coefficient results in overflow, all coefficients up to the first
    coefficient where overflow occurred are also discarded.  This process is
    repeated until the leading coefficient is not a relative zero.

    Class support for input c:
       float: double, single

    See also poly, residue, fzero.

    Documentation for roots
    Other uses of roots
```

Figure 2: Help Roots

2.3 polyval

The `polyval` function evaluates a polynomial for a given set of values. It is useful for analyzing system outputs at specific input values.

2.4 tf

The `tf` function creates a transfer function model from numerator and denominator coefficients. It is essential for representing dynamic systems.

2.5 conv

The `conv` function computes the convolution of two sequences. This is useful for determining the output of a system in response to a given input.

2.6 pzmap

The `pzmap` function generates a pole-zero map of a transfer function. This visualization helps in analyzing system stability and performance.

2.7 impulse

The `impulse` function computes the impulse response of a system. It is vital for understanding how systems respond to sudden inputs.

2.8 step

The `step` function computes the step response of a system. It helps evaluate how a system reacts to a step input over time.

2.9 residue

The `residue` function performs partial fraction decomposition. This is useful for simplifying transfer functions into summable terms.

2.10 series

The `series` function connects two transfer functions in series. This is important for cascading system responses.

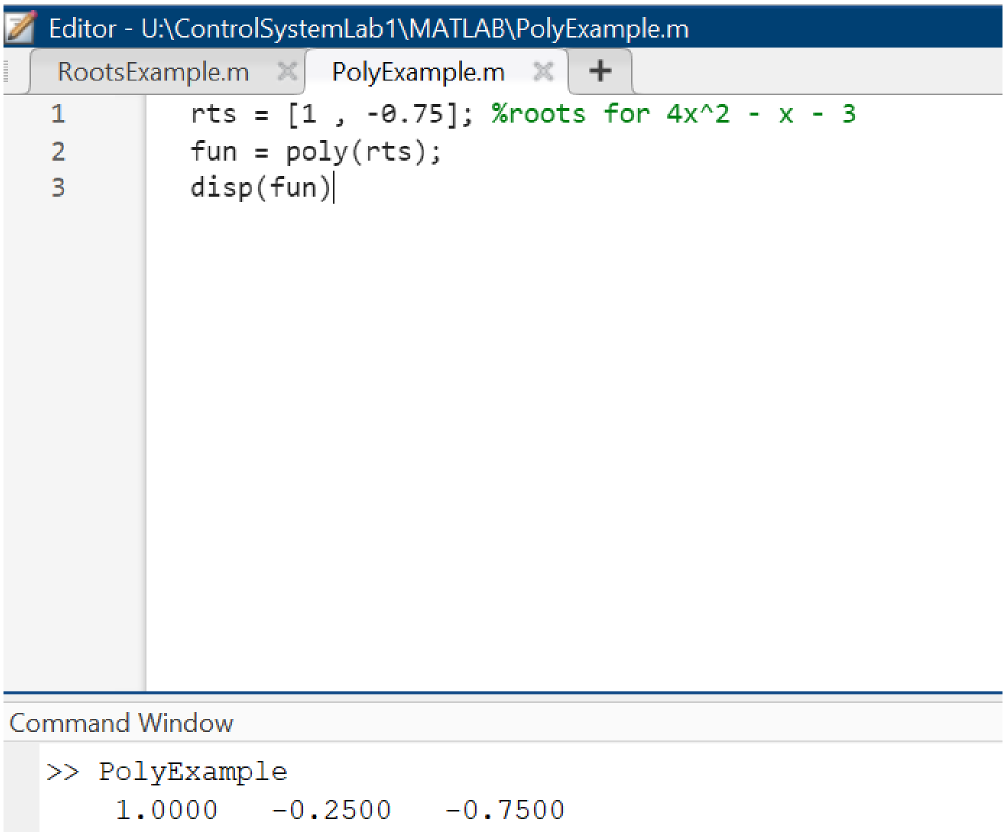

Figure 3: Function: `poly`

2.11 parallel

The `parallel` function combines two transfer functions in parallel. This is useful for systems with multiple pathways.

2.12 feedback

The `feedback` function computes the closed-loop transfer function of a system with feedback. This is essential for analyzing control system stability.

3 Conclusion

This report has presented an overview of key MATLAB functions used in control systems analysis. Each function has its unique application, and understanding them is crucial for effective system design and analysis.

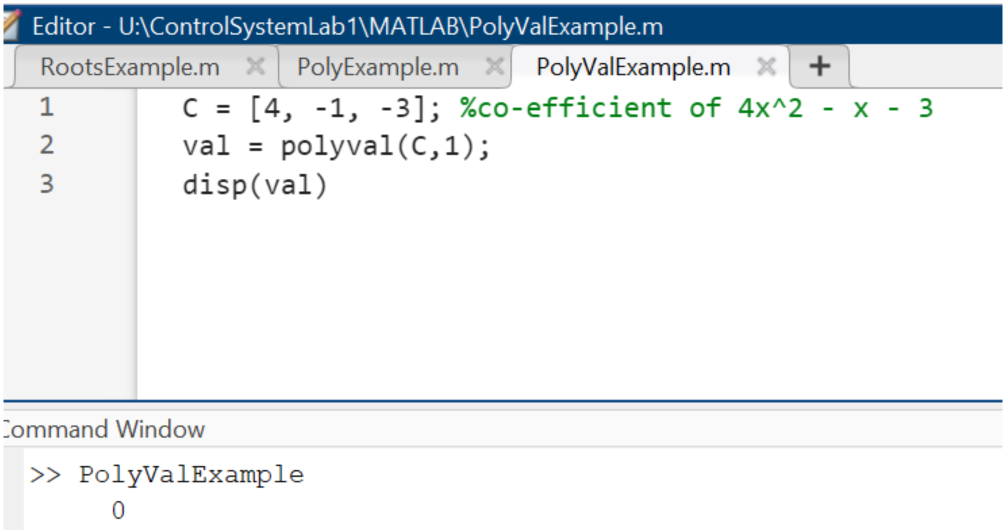

Figure 4: Function: `polyval`

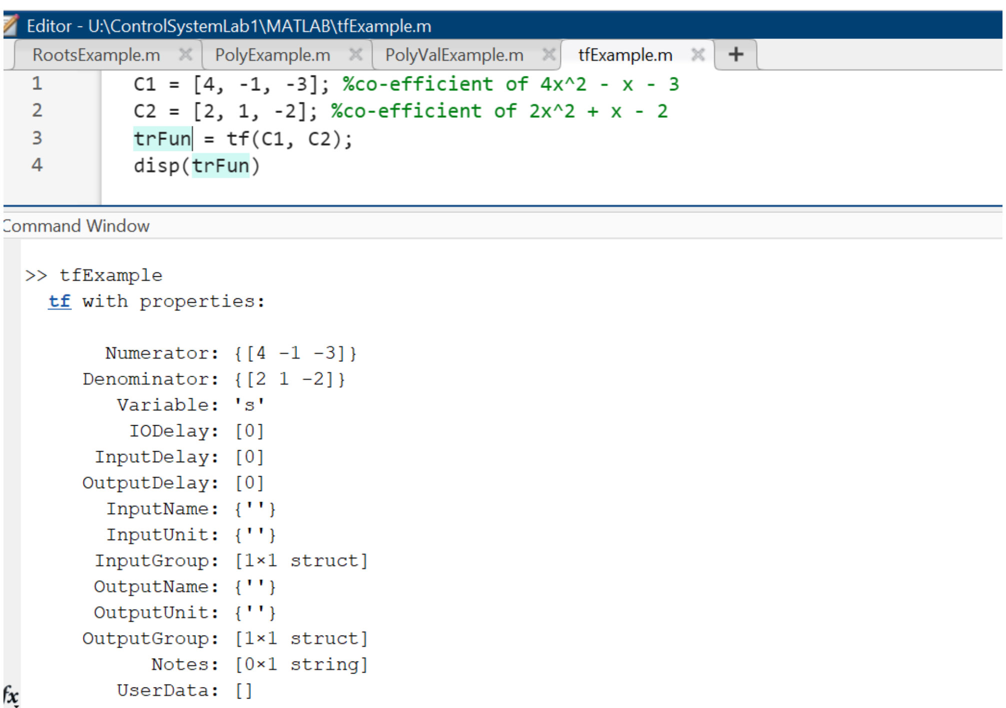

Figure 5: Function: `tf`

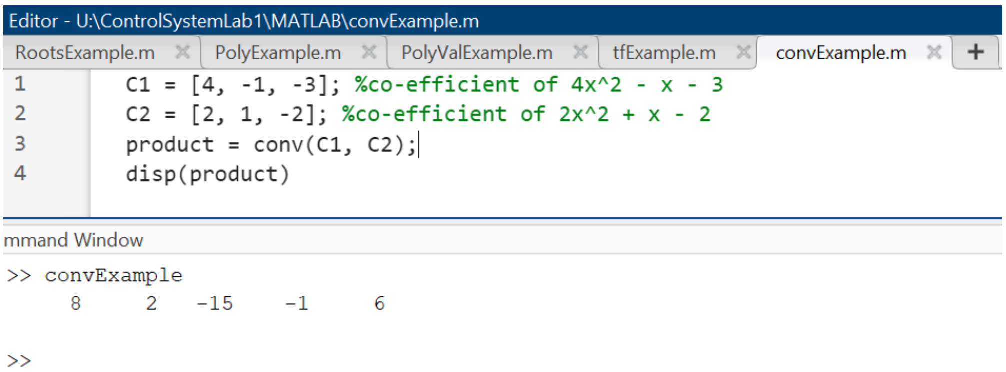

Figure 6: Function: `conv`

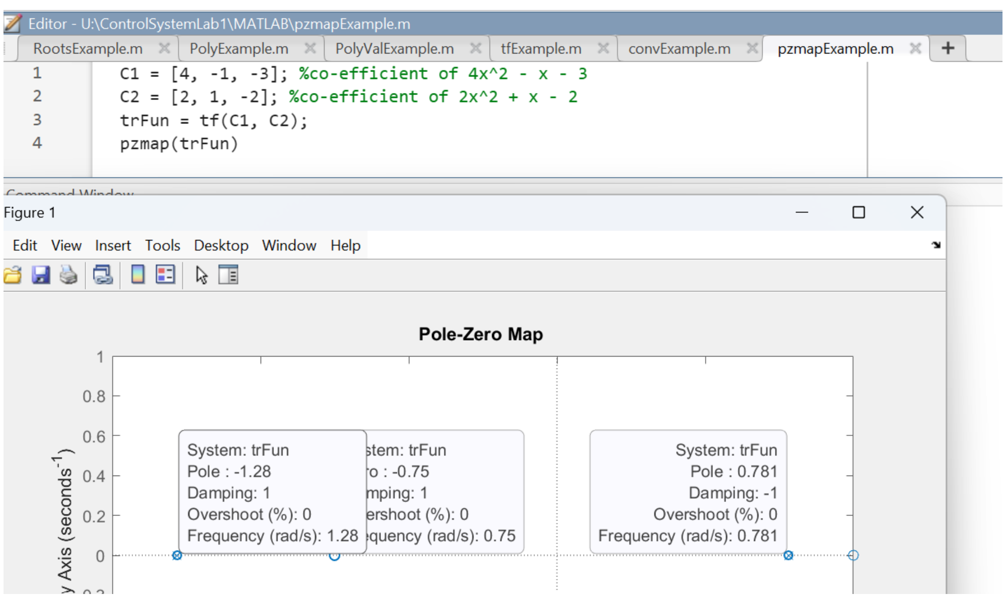

Figure 7: Function: `pzmap`

```
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\section{MATLAB Functions}

\subsection{roots}
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    \label{fig:roots}
```

```
Console output
*geometry* driver: auto-detecting
*geometry* detected driver: pdftex

 LaTeX Error: File `placeholder-image' not found.

See the LaTeX manual or LaTeX Companion for explanation.
Type  H <return>  for immediate help.
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.25 ...cs[width=0.8\textwidth]{placeholder-image}
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Figure 8: Function: `impulse`

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Figure 9: Function: `step`

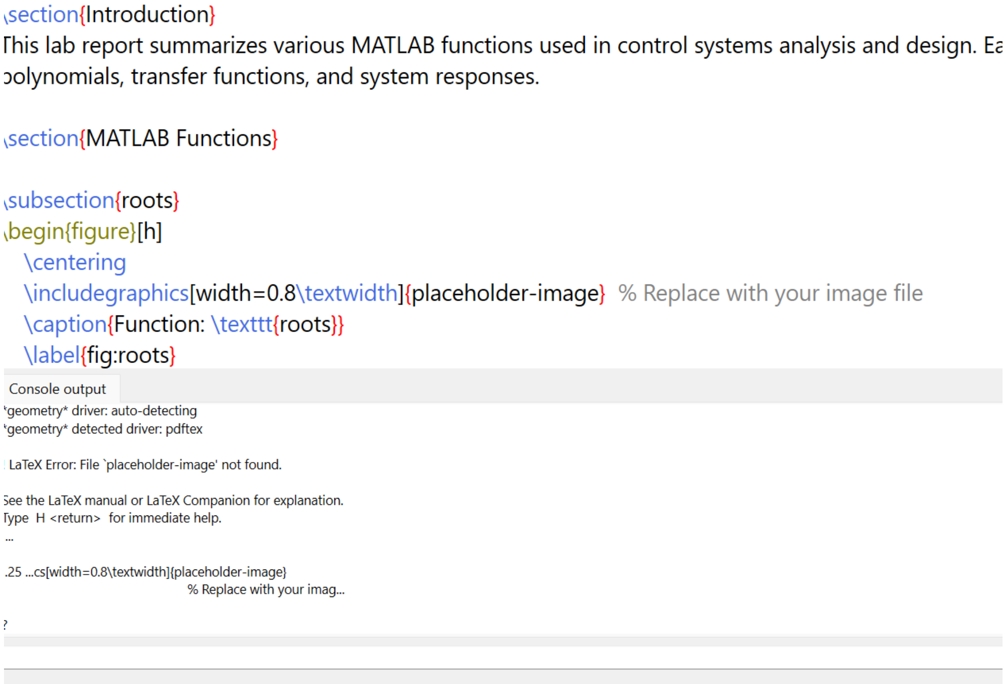

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Figure 10: Function: `residue`

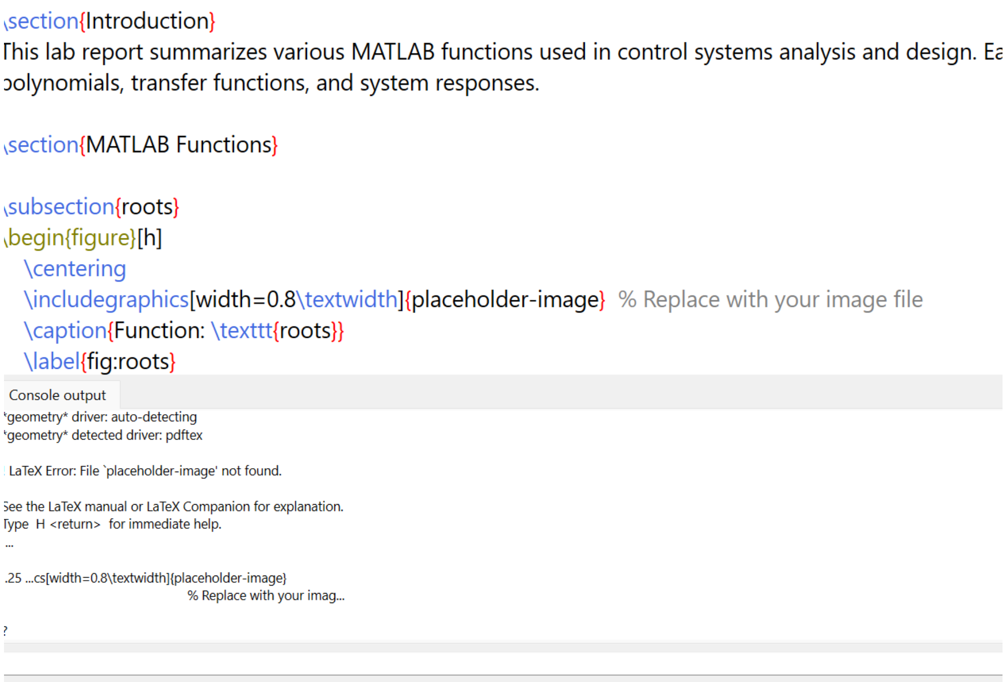


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Figure 11: Function: `series`

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Figure 12: Function: `parallel`

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Figure 13: Function: `feedback`