Experiment 3.2

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Objectives

To learn to use MATLAB and the Symbolic Math Toolbox to

1. Find a symbolic transfer function from the state-space representation.
2. Find a state-space representation from the equations of motion.

Minimum Required Software Packages

MATLAB, the Symbolic Math Toolbox and the Control System Toolbox.

Prelab

Problem 1

Perform Prelab 1 and Prelab 2 of Experiment 3.1 if you have not already done so.

Answer:

Problem 2

Using the equation $T(s) = \mathbf{C}(s\mathbf{I} - \mathbf{A})^{-1}\mathbf{B}$ *to find a transfer function from a state-space representation, write a MATLAB program using the Symbolic Math Toolbox to find the symbolic transfer function from the state-space representation of the translations mechanical system shown in Skill-Assessment Exercise 3.2 and found as a step in Prelab 1.*

Answer:

```
syms s;
T(s) = C*(s*I-A)^-1*B;
```

```
Undefined function or variable 'I'.
```

Problem 3

Using the equations of motion of the translational mechanical system shown in Skill-Assessment Exercise 3.2 and shown below and found in Prelab 1, write a symbolic MATLAB program to find the transfer function, $\frac{X_3(s)}{F(s)}$, for this system.

Answer:

```
%Insert your code here
```

Lab

Problem 1

Run the programs composed in Prelabs 2 and 3 and obtain the symbolic transfer functions by the two methods.

Postlab

Problem 1

Compare the symbolic transfer function obtained from $T(s) = \mathbf{C}(s\mathbf{I} - \mathbf{A})^{-1}\mathbf{B}$ with the symbolic transfer function obtained from the questions of motion.

Problem 2

Discuss the advantages and disadvantages between the two methods.

Problem 3

Describe how you would obtain an LTI state-space representation and an LTI transfer function from your symbolic transfer function.