Chapter 12: Control theory: modeling

chapter12_2_1 Modeling in the Frequency Domain for cases 1, 2, and 3

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% Mechatronics: Principles & Applications
% Elsevier
%
% Mechatronics: Principles & Applications Toolbox Version 1.0
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%
% Chapter 12.2: Modeling in the Frequency Domain
%
% Cases 1, 2, 3 MATLAB's calculating power is greatly enhanced using the
Symbolic
% Math Toolbox. In this example we demonstrate its power by calculating
inverse
% Laplace transforms of F(s). The beginning of any symbolic calculation
requires
% defining the symbolic objects. For example, the Laplace transform variable,
s,
% or the time variable, t, must be defined as a symbolic object. This definition
% is performed using the syms command. Thus, syms s defines s as a
symbolic object;
% syms t defines t as a symbolic object; and syms s t defines both s and t as
% symbolic objects. We need only define objects that we input to the
program.
% Variables produced by the program need not be defined. Thus, if we are
finding
% inverse Laplace transforms, we need only define s as a symbolic object,
since t
% results from the calculation. Once the object is defined, we can then type F
as
% a function of s as we normally would write it. We do not have to use vectors
to
% represent the numerator and denominator. The Laplace transforms or time
functions
% can also be printed in the MATLAB Command Window as we normally
would write it.
% This form is called pretty printing. The command is pretty(F), where F is the
% function we want to pretty  print. In the code below, you can see the
difference
% between normal printing and pretty printing if you run the code without the
% semicolons at the steps where the functions, F or f, are defined.  Once F(s)
is
% defined as F, we can find the inverse Laplace transform using the
command
% ilaplace(F). In the example below, we find the inverse Laplace transforms
of
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% the frequency functions in the examples used for Cases 2 and 3 in Section
2.2
% in the text.
'Example ML1'              % Display label.
syms s                     % Construct symbolic object for
                           % Laplace variable 's'.
'Inverse Laplace transform'  % Display label.
F=3/[(s+2)*(s+3)];           % Define F(s) from Case 2 example.
'F(s) from Case 1'         % Display label.
pretty(F)                  % Pretty print F(s).
f=ilaplace(F);             % Find inverse Laplace transform.
'f(t) for Case 1'          % Display label.
pretty(f)                  % Pretty print f(t) for Case 2.
F=3/[(s+2)*(s+3)^2];       % Define F(s) from Case 3 example.
'F(s) for Case 2'          % Display label.
pretty(F)                  % Pretty print F(s) for Case 3.
f=ilaplace(F);             % Find inverse Laplace transform.
'f(t) for Case 2'          % Display label.
pretty(f)                  % Pretty print f(t) for Case 3.
F=2/[s*(s^2+3*s+4)];       % Define F(s) from Case 3 example.
'F(s) for Case 3'          % Display label.
pretty(F)                  % Pretty print F(s) for Case 3.
f=ilaplace(F);             % Find inverse Laplace transform.
'f(t) for Case 3'          % Display label.
pretty(f)                  % Pretty print f(t) for Case 3.
pause
```