

1: Solve systems of linear equations $Ax = B$ for x - MATLAB `mldivide \`

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2: [PDF] Modern Communication Systems Using Matlab

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Note that when finding transfer functions, we always assume that the each of the initial conditions, $x(0^-)$, $\dot{x}(0^-)$, etc. The transfer function from input to output is, therefore: The poles of the transfer function, s_p , are the roots of the denominator polynomial, $D(s)$. Both the zeros and poles may be complex valued have both real and imaginary parts. The system Gain is. Note that we can also determine the transfer function directly from the state-space representation as follows: Mass-Spring-Damper System The free-body diagram for this system is shown below. The spring force is proportional to the displacement of the mass, $F_s = -kx$, and the viscous damping force is proportional to the velocity of the mass, $F_d = -b\dot{x}$. Both forces oppose the motion of the mass and are, therefore, shown in the negative x -direction. Note also that $x=0$ corresponds to the position of the mass when the spring is unstretched. In this case, there are no forces acting in the x -direction; however, in the $-x$ -direction we have: Later, we will see how to use this to calculate the response of the system to any external input, $F(t)$, as well as to analyze system properties such as stability and performance. To determine the state-space representation of the mass-spring-damper system, we must reduce the second-order governing equation to a set of two first-order differential equations. To this end, we choose the position and velocity as our state variables. Often when choosing state variables it is helpful to consider what variables capture the energy stored in the system. The state equation in this case is: Enter the following commands into the m-file in which you defined the system parameters. Note that we have used the symbolic s variable here to define our transfer function model. We recommend using this method most of the time; however, in some circumstances, for instance in older versions of MATLAB or when interfacing with SIMULINK, you may need to define the transfer function model using the numerator and denominator polynomial coefficients directly. In these cases, use the following commands: When applying KVL, the source voltages are typically taken as positive and the load voltages are taken as negative. RLC Circuit We will now consider a simple series combination of three passive electrical elements: Since this circuit is a single loop, each node only has one input and one output; therefore, application of KCL simply shows that the current is the same throughout the circuit at any given time,. Now applying KVL around the loop and using the sign conventions indicated in the diagram, we arrive at the following governing equation. In particular, they are both second-order systems where the charge integral of current corresponds to displacement, the inductance corresponds to mass, the resistance corresponds to viscous damping, and the inverse capacitance corresponds to the spring stiffness. These analogies and others like them turn out to be quite useful conceptually in understanding the behavior of dynamical systems. The state-space representation is found by choosing the charge on the capacitor and current through the circuit inductor as the state variables.

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7: Robert S. Strum (Author of Contemporary Linear Systems Using MATLAB)

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