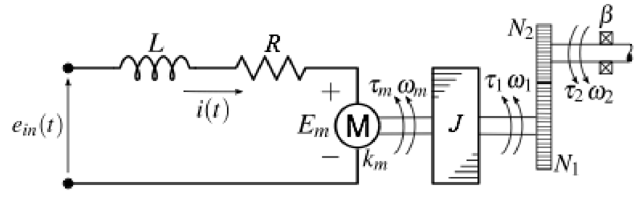
MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Example 4.1

The input to the system is $e_{in}(t)$. The output angular velocity is of interest.



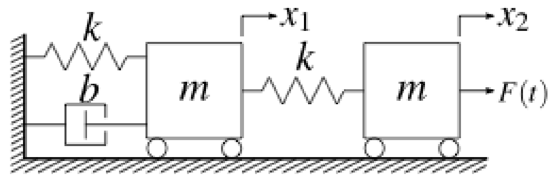
(a)

MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Example 4.2

The input to the system is F(t). The displacements of the masses are of interest.



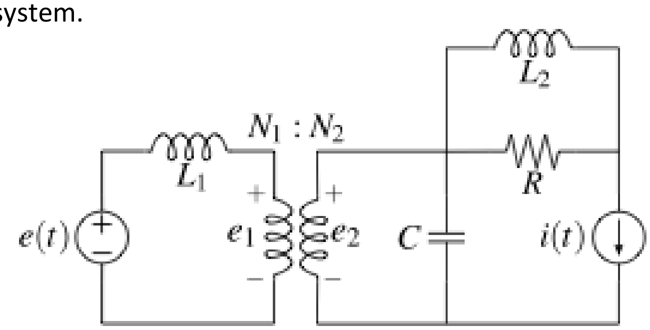

(a)

MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Example 4.3

The inputs to the system are e(t) and i(t). The inductor currents and capacitor voltage are of interest.

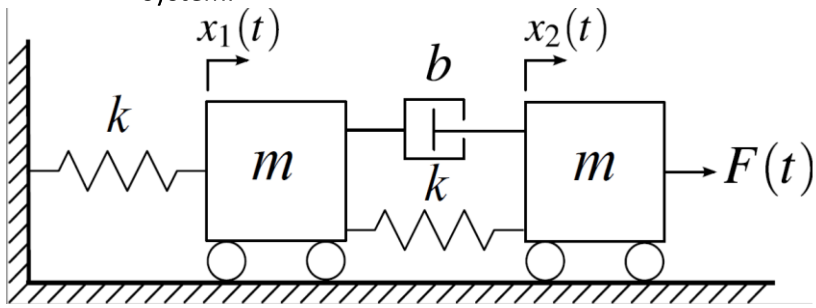


MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Review Problem 1

The input to the system is F(t). The displacements of the masses are of interest.

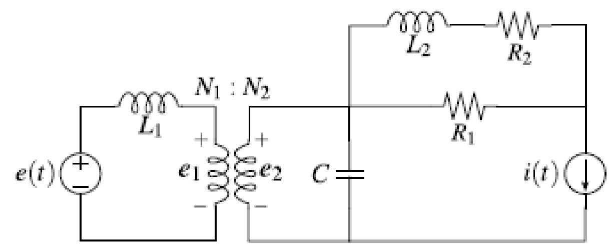


MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Review Problem 2

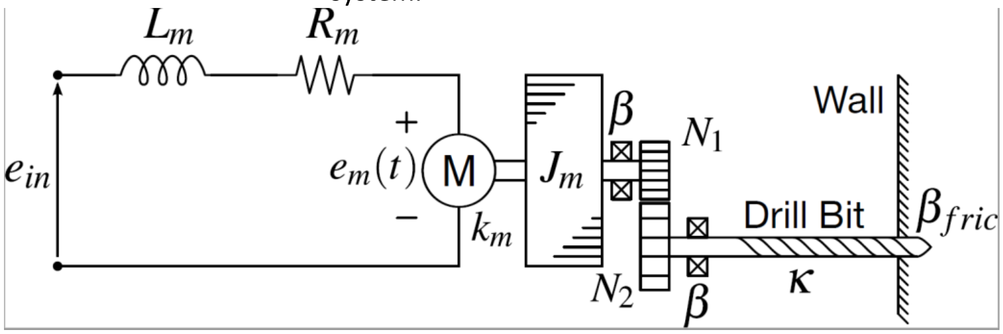
The input to the system is e(t) and i(t). The inductor currents and capacitor voltage is of interest.



MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

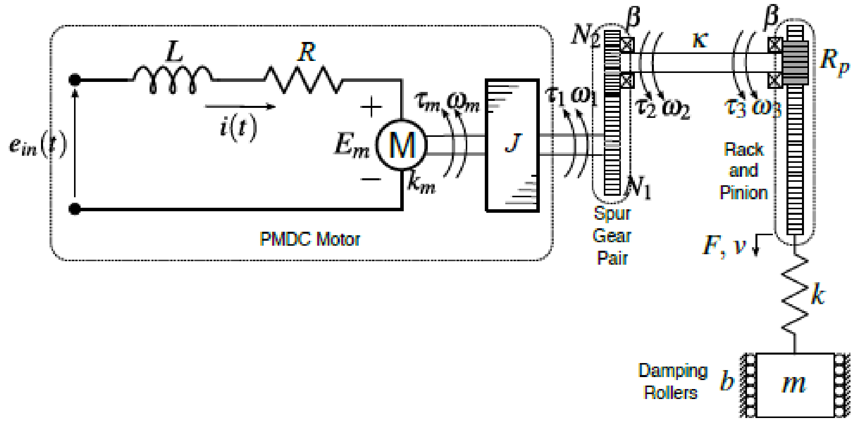
Review Problem 3



MECE 3304 System Dynamics

Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

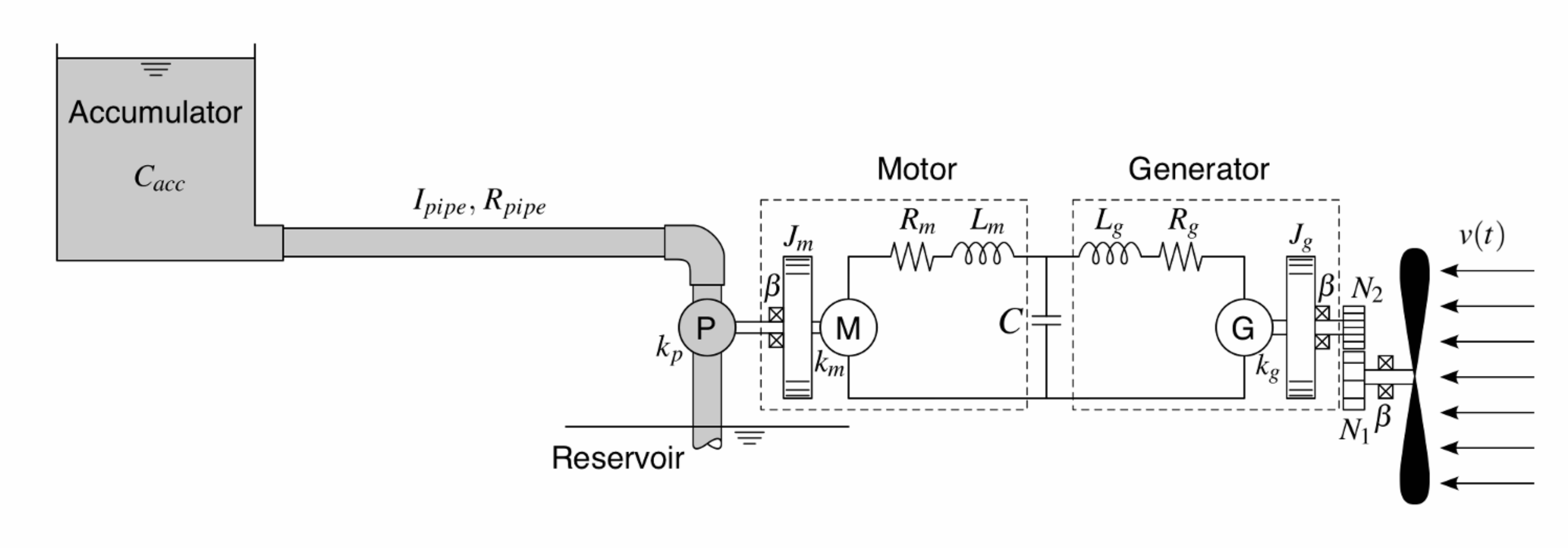
Review Problem 4



MECE 3304 System Dynamics

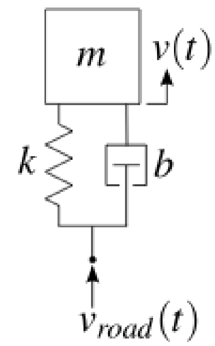
Chapter 4 Lecture Problems: Compose the state-space representation of the state equations for each system.

Challenge Problem



Example 4.4

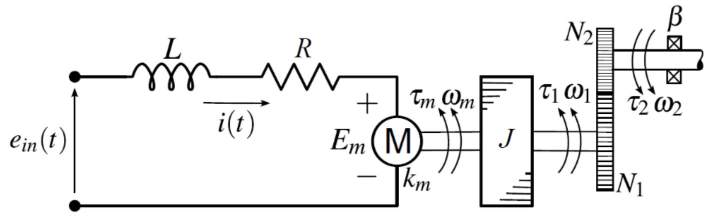
This is a quarter-car suspension model. Typical vehicle mass, damping constant, and spring rate for a family sedan are 1700 kg, 750 Ns/m, and 30 kN/m, respectively. If the vehicle drives over a curb, what is the approximate response?




(a)

Example 4.5

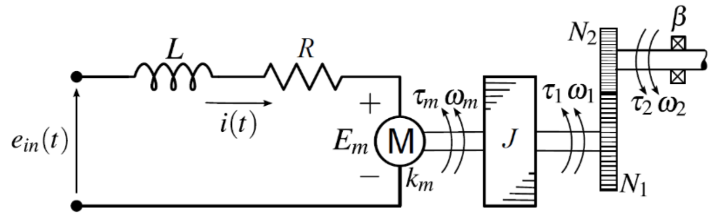
A PMDC motor operates at a constant input voltage. When the voltage is initially applied, the input instantaneously jumps from zero to a constant value just like a step input. A transient response ensues. Plot the response of the system to a 24-volt input.



(a)

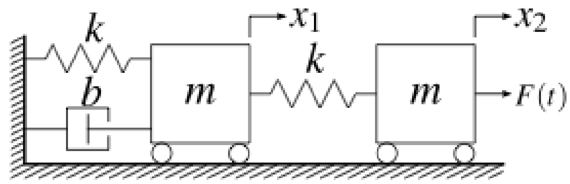
Example 4.6

What would a response of the PMDC motor be if the voltage is ramped from 0 to 24 V in 0.2 seconds and then maintained constant?




(a)

Example 4.7




This mass-spring-damper system has an external force that induces motion. Motion, however, can be induced by simply displacing the system from equilibrium. The first mass can be displaced a given amount and then released resulting in free vibration. Simulate the free vibration response for an initial displacement of the leftmost mass of a few centimeters. Assume that the masses, damping constants, and spring rates are 10 kg, 20 N-s/m, and 60 N/m, respectively.