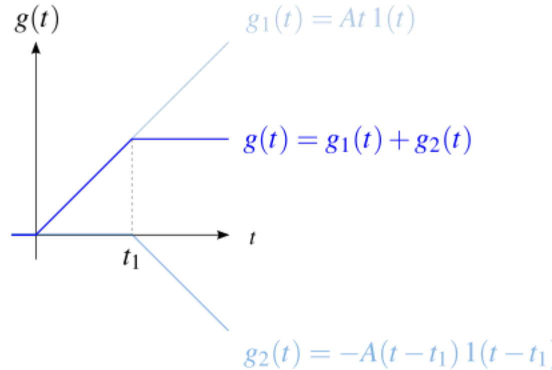
Example 5.1

Find the Laplace transform for the piecewise continuous function in the figure shown.



Example 5.2

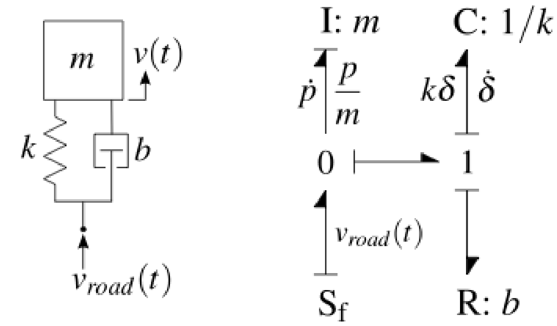
Using the differentiation theorem, derive the Laplace transforms of the untranslated unit step and impulse functions from the unit ramp function.

Example 5.3

Using the integration theorem, beginning with the impulse function, derive the Laplace transforms of the unit step and ramp functions.

Example 5.4

Recall the quarter-car suspension simulated in Example 4.4. Assume for this particular example that the mass, damping constant, and spring rate are 500 kg, 8,000 N-s/m, and 30,000 N/m, respectively. Derive the response of the system to a unit impulse displacement.




(a) (b)

MECE 3304 System Dynamics
Chapter 5 Lecture Problems

Example 5.5

Find the partial fraction expansion of $G(s) = \frac{s+4}{(s+1)(s+2)^2(s+3)}$.

Example 5.6

Find the unit impulse response of the quarter-car suspension from Example 5.4 if the mass, damping constant, and spring rate are 500 kg, 8,000 N-s/m, and 32,000 N/m, respectively. Recall that the transform we derived was $y(s) = \frac{bs+k}{ms^2+bs+k} y_{road}(s)$.

Example 5.7

Find the partial fraction expansion of $G(s) = \frac{s+4}{(s+1)(s^2+2s+5)}$.

Example 5.8

Find the unit impulse response of the quarter-car suspension from Example 5.4 if the mass, damping constant, and spring rate are 500 kg, 8,000 N-s/m, and 34,000 N/m, respectively. Recall that the transform we derived was $y(s) = \frac{bs+k}{ms^2+bs+k} y_{road}(s)$.

Example 5.9

Using MATLAB, find the poles, zeros, and partial fraction expansion of $G(s) = \frac{s^2+9s+20}{s^4+4s^3+10s^2+12s+5}$.