Chapter 11 Figures From

MATHEMATICAL METHODS for Scientists and Engineers

Donald A. McQuarrie

For the Novice Acrobat User or the Forgetful

When you opened this file you should have seen a slightly modified cover of the book *Mathematical Methods for Scientists and Engineers* by Donald A. McQuarrie, a menu bar at the top, some index markers at the left hand margin, and a scroll bar at the right margin.

Select the **View** menu item in the top menu and be sure **Fit in Window** and **Single Page** are selected. Select the **Window** menu item and be sure **Bookmarks** and **Thumbnails** ARE NOT selected.

You can and probably should make the top menu bar disappear by pressing the function key F9. Pressing this key (F9) again just toggles the menu bar back on. You may see another tool bar that is controlled by function key F8. Press function key F8 until the tool bar disappears.

In the upper right hand corner margin of the window containing this text you should see a few small boxes. DO NOT move your mouse to the box on the extreme right and click in it; your window will disappear! Move your mouse to the second box from the right and click (or left click); the window containing this text should enlarge to fill the screen. Clicking again in this box will shrink the window; clicking again will return the display to full screen.

The prefered means of navigation to any desired figure is controlled by the scroll bar in the column at the extreme right of the screen image. Move your mouse over the scroll bar slider, click, and hold the mouse button down. A small window will appear with the text "README (2 of 26)". Continuing to hold down the mouse button and dragging the button down will change the text in the small window to something like "11.4 (6 of 26)". Releasing the mouse button at this point moves you to Figure 11.4 of Chapter 11. The (6 of 26) indicates that Figure 11.4 resides on page 6 of the 26 pages of this document.

ANIMATIONS

Figure 11.16 has an associated animated version that requires QuickTime™ for display. The animation is named Anim11_16.mov and must be independently acquired from the server.

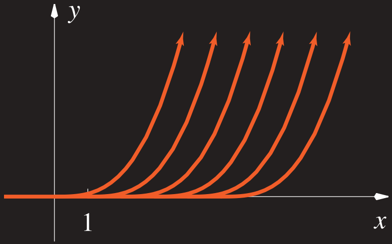

Figure 11.1
The family of solutions of $y' = 3y^{2/3}$ with $y(0) = 0$ given in Example 2.

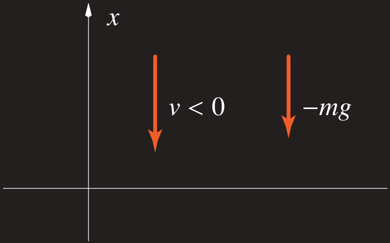

Figure 11.2
The coordinate system used in Example 3. The positive x axis is directed upward, so that $v = dx/dt$ is negative for a falling body.

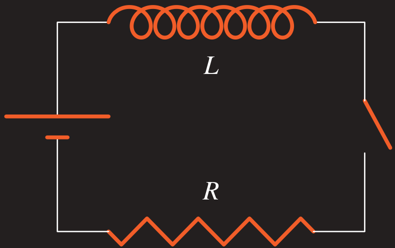

Figure 11.3
An electrical circuit consisting of a resistance R and an inductance L.

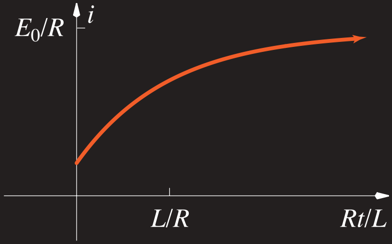

Figure 11.4
The current in Example 1 plotted against Rt/L.

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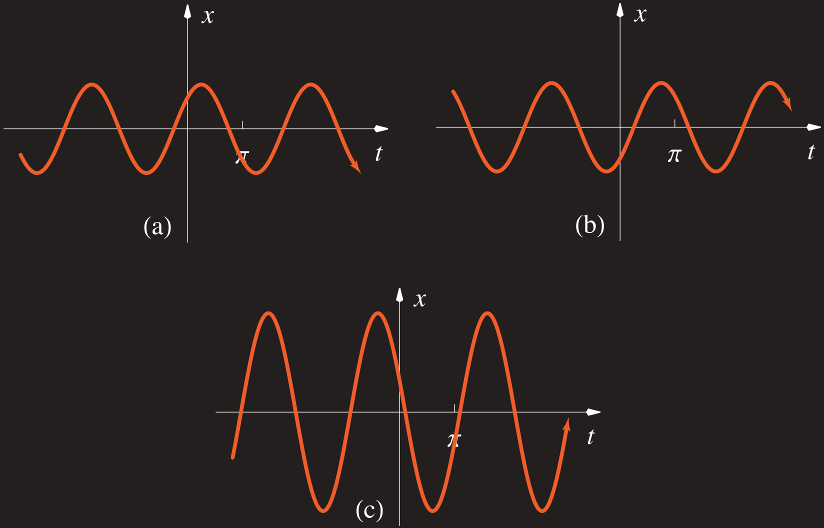


Figure 11.5
The function $x(t) = c_1 \cos t + c_2 \sin t$ plotted against t for various values of c_1 and c_2. Note that the motion is harmonic in all cases.

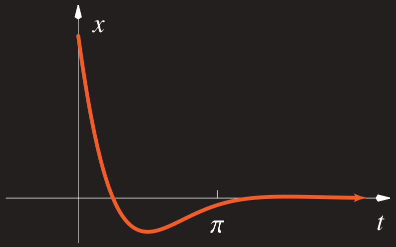


Figure 11.6
The function $x(t)$ given by Equation 18 plotted against t.

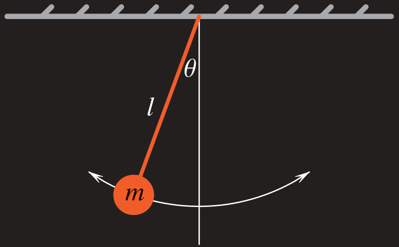


Figure 11.7
A pendulum oscillating in a single plane. The pendulum support is rigid and mass-less, and supports a mass m.

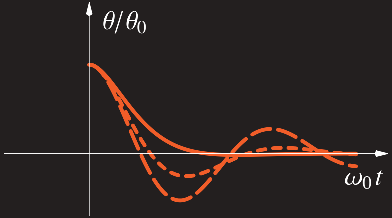


Figure 11.8
Equation 23 plotted against $\omega_0 t$ for several values of $\delta = \gamma/2\omega_0 = 0.2$ (long dashed), 0.4 (short dashed), and 0.8 (solid).

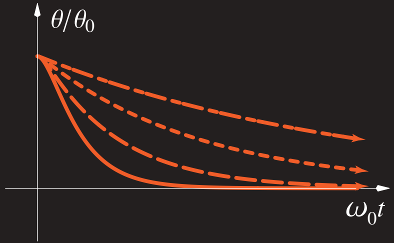


Figure 11.9
Equation 26 plotted against $\omega_0 t$ for several values of $\delta = \gamma/2\omega_0 = 1.1$ (solid), 2.0 (long dashed), 4.0 (short dashed), and 8.0 (dash dot).

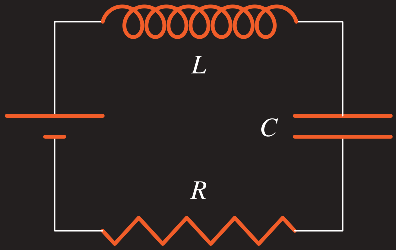


Figure 11.10
An electric circuit containing a resistance, R, and inductance, L, and a capacitance, C.

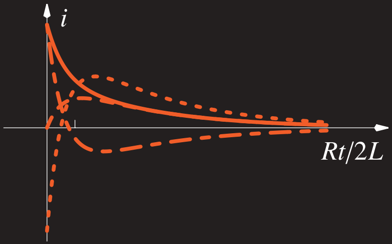


Figure 11.11
Plots of $i(t)$ given by Equation 15 against $Rt/2L$ for $4L/R^2C = 1/2$ for various values of c_1 and c_2. The behavior in this case is called overdamping.

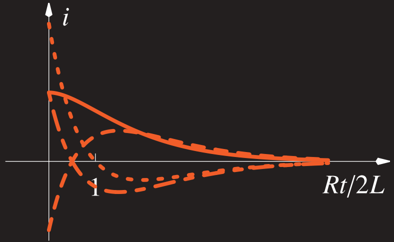


Figure 11.12
Plots of $i(t)$ given by Equation 15 against $Rt/2L$ for $4L/R^2C = 1.0$ for various values of c_1 and c_2. The behavior in this case is called critical damping.

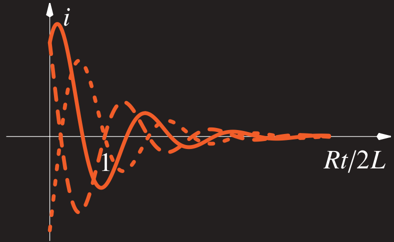


Figure 11.13
Plots of $i(t)$ given by Equation 16 against $Rt/2L$ for $4L/R^2C = 2.0$ for various values of c_1 and c_2. The behavior in this case is called underdamping.

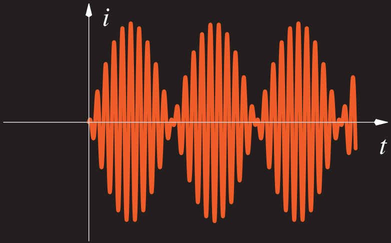


Figure 11.14
Equation 22 plotted against t for $\epsilon = 0.10$ and $\omega_0 = 1.0$, illustrating what is called *amplitude-modulation*.

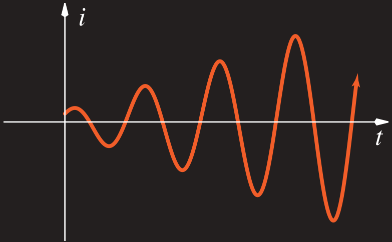


Figure 11.15
An illustration of resonace in an *LC* circuit. The frequency ω_0 is called the resonance frequency.

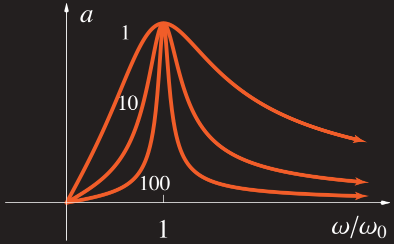


Figure 11.16
The amplitude of the steady-state current in an *RLC* circuit plotted against ω/ω_0 for various values of $L^2\omega_0^2/R^2$, where $\omega_0^2 = 1/LC$.

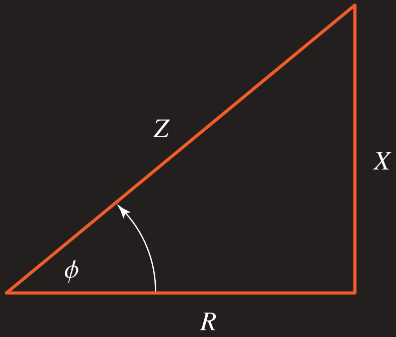


Figure 11.17
A geometric aid to the determination of Equation 32.

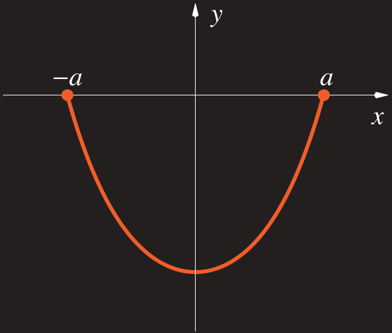


Figure 11.18
A catenary, $y(x) = \frac{1}{\alpha} \cosh \alpha x$, is the shape of an ideal cable suspended at both ends.

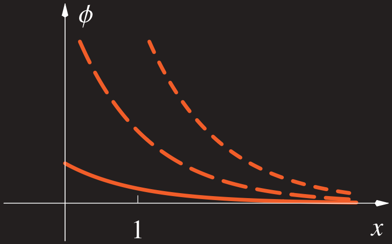


Figure 11.19
The potential calculated from the Poisson-Boltzmann equation (Example 4) plotted against x for $\phi_0 = 0.20$ (solid), 1.00 (long dashed), and 3.00 (short dashed).

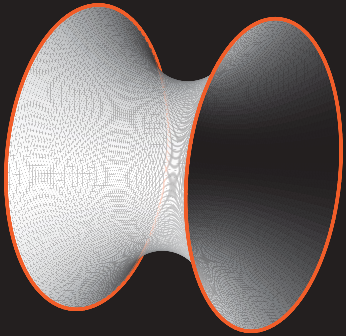


Figure 11.20
A soap film between two parallel concentric rings.

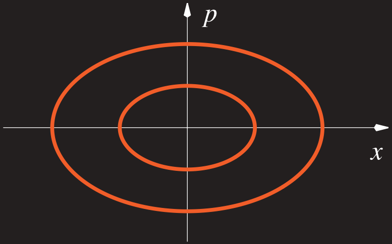


Figure 11.21
A parametric plot of the momentum $p(t)$ against the displacement $x(t)$ for a harmonic oscillator.

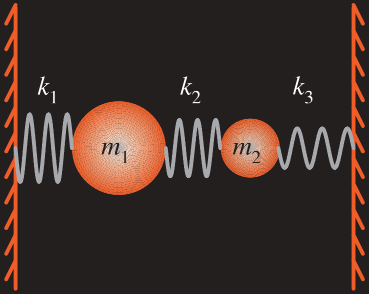


Figure 11.22
The two-mass, three-spring system referred to in Problem 14.

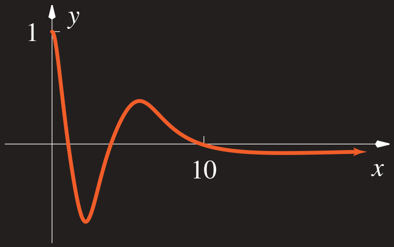
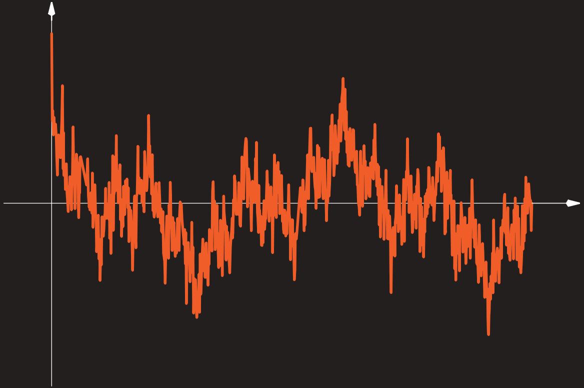


Figure 11.23
A plot of the numerical solution to Equation 1 with the initial conditions $y(0) = 1$ and $y'(0) = 0$.



An approximation to the Weierstrass function using 1000 terms with $a = 3$ and $b = 4/5$.