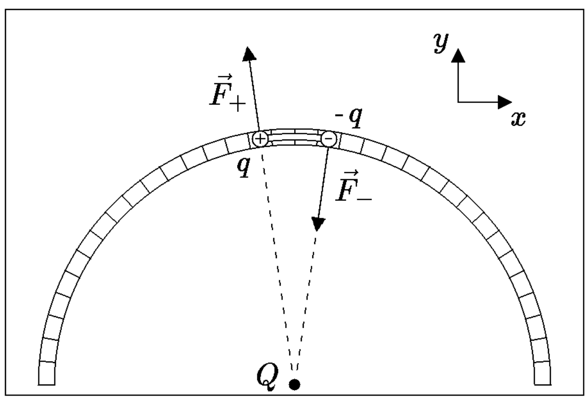
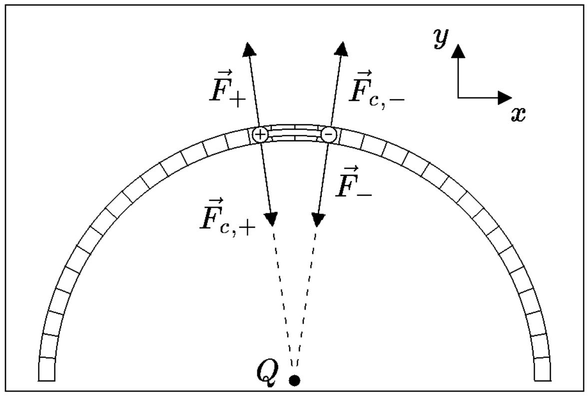
Introduction to Electrodynamics, 4th ed.
by David Griffiths
Corrections to the Instructor's Solution Manual
(These corrections have been made in the current electronic version.)
(December 1, 2015)

- Page 18, Problem 1.50(a): in the box for U_2, $x^3 \to x^2$; in the box for $\mathbf{A}_1$, $x^2 \to x^3$.
- Page 33, Problem 2.24, top line of page: the first + sign should be $-$.
- Page 36, Problem 2.32: in the box, switch $\left(\frac{m_A}{m_B}\right) \leftrightarrow \left(\frac{m_B}{m_A}\right)$ (twice).
- Page 104, Problem 4.31: replace the figure, and the paragraph that follows it, with the following:



Why does't the dipole accelerate, going faster and faster, in obvious violation of conservation of energy? The simple answer is that we have ignored the forces of constraint required to keep the dipole on the track. If the dipole is at rest, these constraint forces ("normal" forces exerted by the track, or perhaps tension in strings tethering them to the center of the circle) exactly cancel the electrostatic forces:

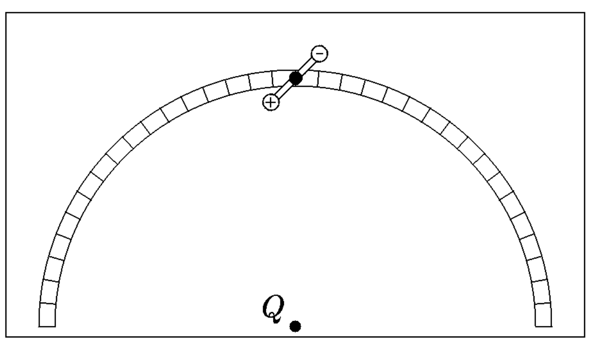


If the dipole is moving at constant speed, there must be an additional constraint force on each charge, to sustain the centripetal acceleration:

$$\mathbf{F}_{\text{add}} = -\frac{mv^2}{R}\,\hat{\mathbf{r}}$$

(where m is the mass of the charge—taking the rod connecting them to be massless—and v is the velocity), but these forces, directed toward the center, provide no tangential acceleration. There is no torque on the dipole—nor is any required, because it rotates at constant angular velocity.

In the general case of tangentially accelerated motion, it is illuminating to adopt a slightly different model. Imagine attaching the dipole to the track in a way that prevents the track from exerting any torque on the dipole, and then supplying an external "torque motor" to control the orientation. For example, the dipole could have a frictionless pivot at its center, which is attached to the track, so the dipole spins freely:



The orientation of the dipole would then be constrained to be tangential by connecting it to the torque motor (which we carefully design so as to exert no net force on the dipole). In this model the constraint force acts only on the pivot, and therefore must be radial, so it cannot cancel the electrostatic force. Thus there will be a net tangential force, and the dipole will accelerate around the track without limit. However, in this case we can easily identify the source of the energy. This is no perpetual motion machine—the energy is supplied by the torque motor.

[My original solution to this problem was incorrect. The error was pointed out by Alan Guth, and the argument provided here (including the figures) is an edited version of his solution, reproduced with his kind permission.]

- Page 111, Problem 5.4: erase "The force on the left ... (to the right);" in favor of "The force on each side is zero;".

- Page 114, Problem 5.15: in the second line of the second box, change $z > -a$ to $z < -a$.

- Pages 145-167: at the top of each page, "ELETRODYNAMICS" → "ELECTRODYNAMICS"

- Page 149, Problem 7.17(b): erase the 2 (twice).

- Page 177, Problem 8.16: insert π in the last three expressions at the bottom of the page.

- Page 183, Problem 8.22: at the end, insert the following:

  If $a < R$, the calculations are unchanged up to the end of the penultimate line, where we must now be careful to take the positive root: $\sqrt{A^2 - B^2} = |a^2 - s^2|$, so

$$\begin{aligned}
\mathbf{p} &= \frac{\mu_0 q n I}{2a}\hat{\mathbf{y}}\int_0^R \left(1 + \frac{(a^2 - s^2)}{|a^2 - s^2|}\right) s\,ds = \frac{\mu_0 q n I}{2a}\hat{\mathbf{y}}\left[\int_0^a (1+1)\,s\,ds \right.\\
&\quad \left. + \int_a^R (1-1)\,s\,ds\right] = \boxed{\tfrac{1}{2}\mu_0 q n I a\,\hat{\mathbf{y}}}.\\
\mathbf{L} &= -\frac{\mu_0 q n I}{2}\hat{\mathbf{z}}\int_0^R \left(1 + \frac{(s^2 - a^2)}{|a^2 - s^2|}\right) s\,ds = -\frac{\mu_0 q n I}{2}\hat{\mathbf{z}}\left[\int_0^a (1-1)\,s\,ds \right.\\
&\quad \left. + \int_a^R (1+1)\,s\,ds\right] = \boxed{-\tfrac{1}{2}\mu_0 q n I(R^2 - a^2)\,\hat{\mathbf{z}}}.
\end{aligned}$$

- Page 187, Problem 9.5: in final expression, $v^2 \to v_2$.

- Page 190, Problem 9.11(c), first line: insert $\frac{1}{T}$ in front of the expression for $(\mathbf{F}_m)_{\text{ave}}$; same for the last equation on the page.

- Page 191, Problem 9.11(d): erase "$= \pi/\omega$"; in the box, erase π and ω, and insert a 2 in the denominator.

- Page 235, Problem 11.8(b): in the denominator, $10^6 \rightarrow 10^9$; in the box, $10^{-6} \rightarrow 10^{-9}$; in the next line, "millionth" → "billionth".