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Preface

This is a textbook on electricity and magnetism, designed for an undergraduate course at the junior or senior level. It can be covered comfortably in two semesters, maybe even with room to spare for special topics (AC circuits, numerical methods, plasma physics, transmission lines, antenna theory, etc.) A one-semester course could reasonably stop after Chapter 7. Unlike quantum mechanics or thermal physics (for example), there is a fairly general consensus with respect to the teaching of electrodynamics; the subjects to be included, and even their order of presentation, are not particularly controversial, and textbooks differ mainly in style and tone. My approach is perhaps less formal than most; I think this makes difficult ideas more interesting and accessible.

For this new edition I have made a large number of small changes, in the interests of clarity and grace. In a few places I have corrected serious errors. I have added some problems and examples (and removed a few that were not effective). And I have included more references to the accessible literature (particularly the *American Journal of Physics*). I realize, of course, that most readers will not have the time or inclination to consult these resources, but I think it is worthwhile anyway, if only to emphasize that electrodynamics, notwithstanding its venerable age, is very much alive, and intriguing new discoveries are being made all the time. I hope that occasionally a problem will pique your curiosity, and you will be inspired to look up the reference—some of them are real gems.

I have maintained three items of unorthodox notation:

- The Cartesian unit vectors are written $\hat{\mathbf{x}}$, $\hat{\mathbf{y}}$, and $\hat{\mathbf{z}}$ (and, in general, all unit vectors inherit the letter of the corresponding coordinate).

- The distance from the z axis in cylindrical coordinates is designated by s, to avoid confusion with r (the distance from the *origin*, and the radial coordinate in spherical coordinates).

- The script letter $\boldsymbol{\mathcal{r}}$ denotes the vector from a source point $\mathbf{r}'$ to the field point $\mathbf{r}$ (see Figure). Some authors prefer the more explicit $(\mathbf{r} - \mathbf{r}')$. But this makes many equations distractingly cumbersome, especially when the unit vector $\hat{\boldsymbol{\mathcal{r}}}$ is involved. I realize that unwary readers are tempted to interpret $\boldsymbol{\mathcal{r}}$ as $\mathbf{r}$—it certainly makes the integrals easier! *Please take note:* $\boldsymbol{\mathcal{r}} \equiv (\mathbf{r} - \mathbf{r}')$, which is *not* the same as $\mathbf{r}$. I think it's good notation, but it does have to be handled with care.[1]

[1] In MS Word, $\boldsymbol{\mathcal{r}}$ is "Kaufmann font," but this is very difficult to install in TeX. TeX users can download a pretty good facsimile from my web site.