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*Electromechanical Dynamics*

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# Appendix B

## REVIEW OF ELECTROMAGNETIC THEORY

### B.1 BASIC LAWS AND DEFINITIONS

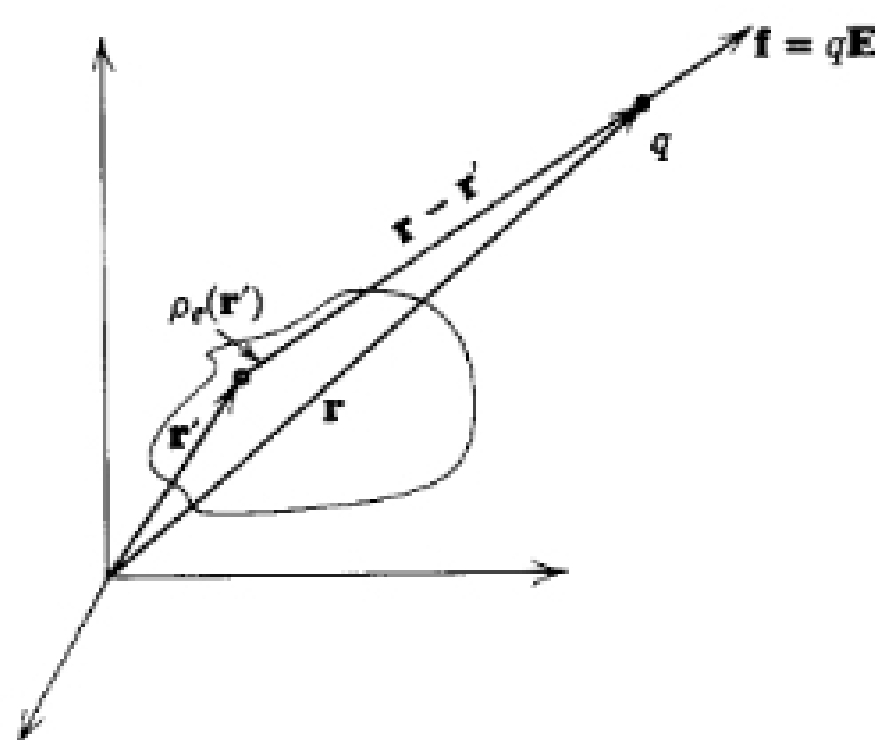
The laws of electricity and magnetism are empirical. Fortunately they can be traced to a few fundamental experiments and definitions, which are reviewed in the following sections. The rationalized MKS system of units is used.

#### B.1.1 Coulomb's Law, Electric Fields and Forces

Coulomb found that when a charge  $q$  (coulombs) is brought into the vicinity of a distribution of *charge density*  $\rho_e(\mathbf{r}')$  (coulombs per cubic meter), as shown in Fig. B.1.1, a force of repulsion  $\mathbf{f}$  (newtons) is given by

$$\mathbf{f} = q\mathbf{E}, \quad (\text{B.1.1})$$

where the *electric field intensity*  $\mathbf{E}$  (volts per meter) is evaluated at the position



**Fig. B.1.1** The force  $\mathbf{f}$  on the point charge  $q$  in the vicinity of charges with density  $\rho_e(\mathbf{r}')$  is represented by the electric field intensity  $\mathbf{E}$  times  $q$ , where  $\mathbf{E}$  is found from (B.1.2).

