Part II

Stationary Field Phenomena

Electromagnetic Foundations of Electrical Engineering J. A. Brandão Faria
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Introduction

Devoted to stationary fields, the second part of this book covers a wide but specific range of electromagnetic phenomena where all scalar quantities and vector fields are independent of time. Accordingly, from Maxwell's equations in (I.1), by making $\partial/\partial t = 0$, we obtain

$$\begin{cases} \text{curl } \mathbf{E} = 0 \\ \text{div } \mathbf{B} = 0 \\ \text{curl } \mathbf{H} = \mathbf{J} \\ \text{div } \mathbf{D} = \rho \end{cases} \tag{PII.1}$$

This set of equations leads to a particularly simple analysis because electric phenomena and magnetic phenomena are decoupled and therefore can be treated independently.

Part II includes three separate chapters. Chapter 2 is concerned with static electric field phenomena. Currents are absent, $\mathbf{J} = 0$, and electric charges are static in space. Hence, key equations for electrostatics are

$$\begin{cases} \text{curl } \mathbf{E} = 0 \\ \text{div } \mathbf{D} = \rho \end{cases} \tag{PII.2}$$

Chapter 3 is concerned with the intrinsic properties of stationary electric currents. From (PII.1), bearing in mind that div curl $\equiv 0$, we have

$$\begin{cases} \text{curl } \mathbf{E} = 0 \\ \text{div } \mathbf{J} = 0 \end{cases} \tag{PII.3}$$

Chapter 4 is concerned with magnetic fields produced by stationary currents. Therefore, from (PII.1), key equations to be examined are

$$\begin{cases} \text{curl } \mathbf{H} = \mathbf{J} \\ \text{div } \mathbf{B} = 0 \end{cases} \tag{PII.4}$$

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