

## 2.1: What is a Field?

The quantity that the field describes may be a scalar or a vector, and the scalar part may be either real- or complex-valued.

### Definition: Field

A field is the continuum of values of a quantity as a function of position and time.

In electromagnetics, the electric field intensity  $\mathbf{E}$  is a real-valued vector field that may vary as a function of position and time, and so might be indicated as “ $\mathbf{E}(x, y, z, t)$ ,” “ $\mathbf{E}(\mathbf{r}, t)$ ,” or simply “ $\mathbf{E}$ .” When expressed as a phasor, this quantity is complex-valued but exhibits no time dependence, so we might say instead “ $\tilde{\mathbf{E}}(\mathbf{r})$ ” or simply “ $\tilde{\mathbf{E}}$ .”

An example of a scalar field in electromagnetics is the electric potential,  $V$ ; i.e.,  $V(\mathbf{r}, t)$ .

A wave is a time-varying field that continues to exist in the absence of the source that created it and is therefore able to transport energy.

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