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Nota di contenuto	Microwave Electronics; Contents; Preface; 1 Electromagnetic Properties of Materials; 1.1 Materials Research and Engineering at Microwave Frequencies; 1.2 Physics for Electromagnetic Materials; 1.2.1 Microscopic scale; 1.2.2 Macroscopic scale; 1.3 General Properties of Electromagnetic Materials; 1.3.1 Dielectric materials; 1.3.2 Semiconductors; 1.3.3 Conductors; 1.3.4 Magnetic materials; 1.3.5 Metamaterials; 1.3.6 Other descriptions of electromagnetic materials; 1.4 Intrinsic Properties and Extrinsic Performances of Materials; 1.4.1 Intrinsic properties; 1.4.2 Extrinsic performances References 2 Microwave Theory and Techniques for Materials Characterization; 2.1 Overview of the Microwave Methods for the Characterization of Electromagnetic Materials; 2.1.1 Nonresonant

methods; 2.1.2 Resonant methods; 2.2 Microwave Propagation; 2.2.1 Transmission-line theory; 2.2.2 Transmission Smith charts; 2.2.3 Guided transmission lines; 2.2.4 Surface-wave transmission lines; 2.2.5 Free space; 2.3 Microwave Resonance; 2.3.1 Introduction; 2.3.2 Coaxial resonators; 2.3.3 Planar-circuit resonators; 2.3.4 Waveguide resonators; 2.3.5 Dielectric resonators; 2.3.6 Open resonators 2.4 Microwave Network 2.4.1 Concept of microwave network; 2.4.2 Impedance matrix and admittance matrix; 2.4.3 Scattering parameters; 2.4.4 Conversions between different network parameters; 2.4.5 Basics of network analyzer; 2.4.6 Measurement of reflection and transmission properties; 2.4.7 Measurement of resonant properties; References; 3 Reflection Methods; 3.1 Introduction; 3.1.1 Open-circuited reflection; 3.1.2 Short-circuited reflection; 3.2 Coaxial-line Reflection Method; 3.2.1 Open-ended apertures; 3.2.2 Coaxial probes terminated into layered materials 3.2.3 Coaxial-line-excited monopole probes 3.2.4 Coaxial lines open into circular waveguides; 3.2.5 Shielded coaxial lines; 3.2.6 Dielectric-filled cavity adapted to the end of a coaxial line; 3.3 Free-space Reflection Method; 3.3.1 Requirements for free-space measurements; 3.3.2 Short-circuited reflection method; 3.3.3 Movable metal-backing method; 3.3.4 Bistatic reflection method; 3.4 Measurement of Both Permittivity and Permeability Using Reflection Methods; 3.4.1 Two-thickness method; 3.4.2 Different-position method; 3.4.3 Combination method; 3.4.4 Different backing method 3.4.5 Frequency-variation method 3.4.6 Time-domain method; 3.5 Surface Impedance Measurement; 3.6 Near-field Scanning Probe; References; 4 Transmission/Reflection Methods; 4.1 Theory for Transmission/reflection Methods; 4.1.1 Working principle for transmission/reflection methods; 4.1.2 Nicolson-Ross-Weir (NRW) algorithm; 4.1.3 Precision model for permittivity determination; 4.1.4 Effective parameter method; 4.1.5 Nonlinear least-squares solution; 4.2 Coaxial Air-line Method; 4.2.1 Coaxial air lines with different diameters; 4.2.2 Measurement uncertainties; 4.2.3 Enlarged coaxial line 4.3 Hollow Metallic Waveguide Method

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#### Sommario/riassunto

The development of high speed, high frequency circuits and systems requires an understanding of the properties of materials functioning at the microwave level. This comprehensive reference sets out to address this requirement by providing guidance on the development of suitable measurement methodologies tailored for a variety of materials and application systems. Bringing together coverage of a broad range of techniques in one publication for the first time, this book: Provides a comprehensive introduction to microwave theory and microwave measurement techniques. Examines every

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