Electromagnetic Variables Measurement

37 Voltage Measurement *Alessandro Ferrero, Jerry Murphy, Cipriano Bartoletti, Luca Podestà, Giancarlo Sacerdoti*
Meter Voltage Measurement • Oscilloscope Voltage Measurement • Inductive Capacitive Voltage Measurement

38 Current Measurement *Douglas P. McNutt*
Definition of the Ampere • Magnetics • Shunts • The Moving Magnet Meter • The D'Arsonval Meter • The Electrodynamometer • The RF Ammeter and True rms • The Current Transformer • Gapped Inductive Sensors • Hall Effect Sensor • Clamp-on Sensors • Magnetoresistive Sensors • The Magnetic Amplifier • Fluxgates • Optical Sensors • Fault Indicators • Other Schemes • Some Generalities and Warnings • Current Actuated Switches and Indicators • Where to Get Current Sensors

39 Power Measurement *Pasquale Arpaia, Francesco Avallone, Aldo Baccigalupi, Claudio De Capua, Carmine Landi*
Power Measurements in dc Circuits • Power Measurements in ac Circuits • Pulse Power Measurements

40 Power Factor Measurement *Michael Z. Lowenstein*
Reasons for Interest in Power Factor • Ac Electric Loads • Ac Power Relationships • Power Factor "Measurement" • Instrumentation

41 Phase Measurement *Peter O'Shea*
Amplitude, Frequency, and Phase of a Sinusoidal Signal • The Phase of a Periodic Nonsinusoidal Signal • Phase Measurement Techniques • Phase-Sensitive Demodulation • Power Factor • Instrumentation and Components

42 Energy Measurement *Arnaldo Brandolini, Alessandro Gandelli*
Dc Energy Measurement • Ac Induction Energy Meters • Static Energy Meters • Accuracy of Energy Meters

43 Electrical Conductivity and Resistivity *Michael B. Heaney*
Basic Concepts • Simple Model and Theory • Experimental Techniques for Measuring Resistivity

44 Charge Measurement *Saps Buchman, John Mester, T. J. Sumner*
Electrostatic Voltmeters • Charge Amplifiers • Applications

45 Capacitance and Capacitance Measurements *Halit Eren, James Goh*
Types of Capacitors • Characteristics of Capacitors

46 Permittivity Measurement *Devendra K. Misra*
Measurement of Complex Permittivity at Low Frequencies • Measurement of Complex Permittivity Using Distributed Circuits

47 Electric Field Strength *David A. Hill, Motohisa Kanda*
Electrostatic Fields • ELF and ULF Electric Fields • Radio-Frequency and Microwave Techniques • Three-Loop Antenna System • Broadband Dipole Antennas

48 Magnetic Field Measurement *Steven A. Macintyre*
Magnetic Field Fundamentals • Low-Field Vector Magnetometers • High-Field Vector Gaussmeters • Scalar Magnetometers

49 Permeability and Hysteresis Measurement *Jeff P. Anderson, Richard J. Blotzer*
Definition of Permeability • Types of Material Magnetization • Definition of Hysteresis • Core Loss • Measurement Methods • Validity of Measurements

50 Inductance Measurement *Michał Szyper*
Definitions of Inductance • Equivalent Circuits and Inductive Element Models • Measurement Methods • Instrumentation

51 Immittance Measurement *Achim Dreher*
Definitions • Ideal Lumped Components • Distributed Elements • Interconnections and Graphical Representations • Measurement Techniques • Instrumentation and Manufacturers

52 *Q* Factor Measurement *Albert D. Helfrick*
Basic Calculation of *Q* • Bandwidth and *Q* • The *Q*-Meter • Other *Q* Measuring Techniques • Measuring Parameters Other than *Q*

53 Distortion Measurement *Michael F. Toner, Gordon W. Roberts*
Mathematical Background • Intercept Points (IP) • Measurement of the THD • Conclusions

54 Noise Measurement *W. Marshall Leach, Jr.*
Thermal Noise • Spectral Density • Fluctuation Dissipation Theorem • Equivalent Noise Resistance and Conductance • Shot Noise • Flicker Noise • Excess Noise • Burst Noise • Partition Noise • Generation–Recombination Noise • Noise Bandwidth • Noise Bandwidth Measurement • Spot Noise • Addition of Noise Voltages • Correlation Impedance and Admittance • The v_n-i_n Amplifier Noise Model • Measuring $\overline{v_{ni}^2}$, $\overline{v_n^2}$, and $\overline{i_n^2}$ • Noise Temperature • Noise Reduction with a Transformer • The Signal-to-Noise Ratio • Noise Factor and Noise Figure • Noise Factor Measurement • The Junction Diode Noise Model • The BJT Noise Model • The FET Noise Model • Operation Amplifier Noise Models • Photodiode Detector Noise Model • Piezoelectric Transducer Noise Model • Parametric Amplifiers • Measuring Noise

55 Microwave Measurement *A. Dehé, K. Beilenhoff, K. Fricke, H. Klingbeil, V. Krozer, H. L. Hartnagel*
Power Measurement • Frequency Measurement • Spectrum Analysis • Cavity Modes and Cavity *Q* • Scattering Parameter Measurements