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International Bureau of Weights and Measures (BIPM); Committees of the BIPM and other international organizations, created for particular tasks of common interest; International liaison; The BIPM and the World Metrological Organization; Conclusion; The CIPM MRA; Introduction; The CIPM MRA: what, why and how?
The mechanisms of the CIPM MRA and the KCDB International comparisons - Equivalence; Calibration and Measurement Capabilities (CMCs) - Recognition; How does the CIPM MRA help?; Conclusions; Mathematical tools in metrology; Error, uncertainty and probability; Introduction; Reference documents; Properties, quantities and units; Stevens' classification; Quantity values - True value; Measurement, measurand and measurement result; Error and uncertainty; Error; Uncertainty; Error approach vs. uncertainty approach; The GUM approach to uncertainty; Ill-defined measurand and definitional uncertainty
Indirect measurement Error propagation vs. uncertainty propagation; Evaluating (and propagating) uncertainties - change of paradigm; Random and systematic effects; Frequentist and Bayesian (or subjective) approaches; No longer room for errors; Coverage intervals-propagation of PDFs; Bayesian inference; Discrete quantities; Conclusions; Frequency instability: Characterization of quasi-periodic signals; Introduction; The frequency-fluctuation description model; Model for the frequency-domain measurements; Measurement systems in the frequency domain; Use of a fringe-side frequency-discriminator Use of a Fabry-Perot with the PDH frequency lock Use of the Michelson interferometer; Characterization of an oscillator by means of cross-correlation; Measurement systems in the time domain; Characterization of a single-oscillator stability by means of cross-variances; The dual-mixer time-difference technique; Time-domain statistical characterization; Relationships between sample variances and spectral densities; Other types of variances; The modified Allan variance (MVAR); Conclusions; Frequency instability: Deterministic contributions and slowly varying noise; Introduction
The signal model under analysis

Sommario/riassunto

The reliability and accuracy of systems of measurement continue to advance. We are about to enter a period of the most stable measurement system we can imagine with the anticipated new definitions of the SI units of measurement; a direct link between fundamental physics and metrology which will eliminate the current definition of the kilogram, until now based upon an artifact.This book presents selected papers from Course 185 of the Enrico Fermi International School of Physics, held in Varenna, Italy, in July 2012 and jointly organized with the Bureau International des Poids et Mesures (BIPM).