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PETE STEIN'S UNIFIED APPROACH TO THE ENGINEERING OF MEASUREMENT SYSTEMS has transformed the design, execution, and application of measurement systems in all disciplines into a rational, systematic, methodical procedure. From 1959–1977 it formed the basis of B.S., M.S., and Ph.D. degrees in Measurement Systems at Arizona State University.

About Pete Stein

Pete holds two B.Sc. degrees and an M.Sc. from M.I.T. in Cambridge, Massachusetts, where he founded Stein Engineering Services in 1950. He then served for four years as Group Leader, Instrumentation Engineering, at a small-gas-turbine manufacturer in Phoenix, Arizona. There, he was responsible for planning measurement systems, selecting transducers and instrumentation, organizing test procedures, and harvesting provably valid data. Yet he soon realized that his otherwise excellent education had not prepared him for these tasks. Consequently he devoted his career to developing his Unified Approach to the Engineering of Measurement Systems.

Pete was affiliated with universities for 23 years, 14 of them as full professor of engineering at Arizona State University (ASU). He has been a visiting professor not only of mechanical engineering (Stanford University), but also of electrical engineering (Technical University of Braunschweig, Germany), and of civil engineering (Technical University of Denmark).

He is a Senior Member of IEEE, Fellow of the Instrument Society of America (ISA), and Fellow of the Society for Experimental Mechanics (SEM)—all honors awarded to him for developing his Unified Approach to the Engineering of Measurement Systems.

He is a founding member of the Western Regional Strain Gage Committee, as well as editor-publisher of the journal *Strain Gage Readings*, 1956–1964, devoted to experimental stress analysis. He was, for 24 years, a delegate and board member of the National Conference of Standards Laboratories. He served on the National Academy of Sciences Evaluation Panels of the National Bureau of Standards (now NIST) for their Mechanics Division, Electronic Technology Division, and for the Center of Mechanical Engineering & Process Technology.

He has received the Frocht Educator Award (from SEM—twice), the Eckman Educator Award (from ISA), the Faculty Achievement Award (from ASU), and SEM's Tatnall Award for Service to the Society.

Among the Topics Covered in the Lectures

THE ENGINEERING OF MEASUREMENT SYSTEMS FOR TEST & EVALUATION

The unified six-terminal transducer model • System responses to environments—the 15 noise levels in every link in the measurement chain • Noise diagnostics and documentation, including the three types of check channels • Signal enhancement and noise suppression—the six families of noise suppression possibilities • Common mode problems in electrical, mechanical, thermal, optical, and fluidic systems: a unified approach • Carrier systems for noise suppression • Shielding, absorbing or isolating for noise suppression: mechanical, electrical, and magnetic shields • The individuality of hardware: key to understanding transducers • Data validation—the 17 data validation procedures • Calibration certificate as "golden calf" (false security) • Information as patterns of properties of wave shapes • Measurement system design and selection: a dozen performance criteria traded off with a dozen design criteria • Acoustics as an aid to measurement system validation • Material properties as they affect transducer design & performance • Knowledge-based systems for test data acquisition and reduction

Applications

Mechanical, electrical, fluidic, and thermal measurements in steady state or transient magnetic and thermal environments • Measurements when noise levels exceed signal level and correlate with it in both time and frequency. (This includes all electromagnetic vibration tests and pyroshock, explosion, and impact tests!) • High-speed transient measurements: pyroshock, explosion, and impact • Rotating machinery vibrations • Systematic vibration test planning • Thermocouples for steady and transient tests on surfaces, in solids, and in high-velocity gas streams—the gradient approach • Flow measurement: problems and approaches • Piezoelectric transducers: properties, problems, applications • Strain gages as transducer components

THE DYNAMICS OF MEASUREMENT SYSTEMS FOR TEST & EVALUATION

System linearity as prime criterion for dynamic measurements • First, second, and higher-order systems: a unified approach • Frequency and transient response: concepts, applications, and compensation (including linearity compensation) • Laws of measurement system behavior: linearity; superposition; time relationships; Duhamel and Bush integrals • Information-reproduction criteria (frequency-content, wave-shape, and peak-to-peak reproduction; coincidence measurements) • Information-shaping criteria: integrating and differentiating • Data validation for: rise-time (high-frequency) problems, undershoot (low-frequency) problems, impact-excited resonances, and sweep speed effects • Filter design and selection criteria • Transducer calibration under dynamic conditions • Transverse or cross sensitivity effects • Data analysis and correction procedures

Applications

Mechanical, electrical, fluidic, and thermal systems under steady-state and transient excitation