Testing; Generation Transmission and Distribution; Transportation, Land and Air; Electromechanical Applications; Electric Welding and Cutting; Feedback-Control Systems; Illuminating Engineering; Electrochemistry and Electrometallurgy; Electrocommunication; Electronics; Radiology; Electrobiology and Electrotherapeutics; Miscellaneous Appliances and Equipment; Automatic Station Control, Supervisory and Telemetering Equipments; Indicating Instruments; Recording Instruments; Industrial Control Apparatus; Electric Railway Control Apparatus; Wire and Cable.

10 ASME definitions include:

Instruments and Apparatus, Power Test Codes; Limits and Fits; Automatic Control; Screw Threads; Shock and Vibration Instrumentation; Fluid Meters; Gears; Surface Quality; High-Pressure Measurement.

11 IRE definitions include:

Antennas, Modulation Systems, and Transmitters; Network Topology; Electroacoustics; Electron Tubes; Magnetrons; Gas-Filled Radiation Counter Tubes; Electronic Computers; Facsimile; Modulation Systems; Radio Aids to Navigation; Piezoelectric Crystals; Radio Receivers; Pulses; Transducers; Color Terms; Television; Wave Propagation; Antennas and Waveguides.

12 Other groups formulating definitions relating to measurement and control:

Acoustical Society of America—Acoustics; Pressure Microphones; Audiometers; Sound Level Meters; Noise.

American Chemical Society—Balances and Weights.

American Medical Association—Atomic Energy and Nuclear Physics.

American Society for Metals—Metallurgy.

American Society for Testing Materials—Color; Acidity; Additions (Cement); Adhesion and Adhesives; Aggregates; Aniline Paint; Ultraviolet Spectrophotometry; Bituminous Waterproofing and Roofing; Calorific Value; Copper-Base Alloys; Cast Iron; Coal and Coke; Ceramic Whiteware; Mortars; Conditioning and Weathering; Panels for Building Construction; Cotton Fibers and Yarns; Cutting Fluids; Density by Pycnometer; Directional Reflectance; Rubber and Synthetic Elastometers; Distillation Range; Drying Oils; Electrical Insulating Oils; Extensometers; Felt; Refractories; Gaseous Fuels; Glass and Glass Products; Industrial Water; Gypsum; Heat-Treatment of Metals; Insulating Materials; Magnetic Testing; Paving Materials; Metallography; Mechanical Testing; Lubricating Oil; Molding Powders; Building Stone; Naval Stores; Traffic Paints; Oxidation Stability; Paints and Varnishes; Paper, Petroleum Products; Plastics; Porcelain Enamel; Portland Cement; Powder Metallurgy; Radiographic Inspection; Rheological Properties; Sand; Shear and Tensile Strength; Shipping Containers; Soaps; Soil Mechanics; Specific Gravity; Specular Gloss; Steel Products; Tall Oils; Thermometers; Textiles; Thermal Conductance and Transmittance; Tile; Water Vapor Permeability; Woods, Veneers and Timber; Wrought Iron; Wove Yarns.

Federal Specification, Government Printing Office—Analytical Balances.

Instrument Society of America.

National Research Council—Nuclear Science and Technology.

National Telemetering Conference—Electrical Telemetering.

Optical Society of America—Photographic Objective Lenses; Radiometry and Photometry; Colorimetry.

Scientific Apparatus Manufacturers of America—Accuracy, Response and Sensitivity of Industrial Instruments.

Society of Applied Spectroscopy.

Society of Automotive Engineers—Lubricants; Bearings; Bolts and Nuts; Brakes and Brake Operation; Crank-Case Oils; Heat-Treating; Hydrodynamic Drives; Serrations and Splines; Pistons and Rings; Ride and Vibration; Screw Threads.

U. S. Department of Defense, Research and Development Board—Guided Missiles.

Discussion

W. B. Heinz.[4] If anyone was ever well qualified to write on a stated subject, the author is qualified to write on terminology. He has participated through the years in the work of the Instruments and Regulators Division Terminology Committee. Through his visits to England and his translations of German papers on automatic control he has had better opportunity than most of us American engineers to incorporate philosophies from other countries in the development of his own. It is his philosophical examination and classification of the terminology problem which outstandingly characterizes his paper.

It is interesting to note the difference he gives between the rights and duties of a lexicographer and those of a terminologist. The lexicographer writes a dictionary as a report on all used words, while the terminologist discriminates among them and creates some, often before usage has come to be. If the paper can stimulate new and wider interest in this important and entertaining work and thus cause others to terminologize before conflicting usages have grown, it may prove of wider benefit than even he himself might hope!

The author's comment on universality of concepts suggests an example which arose early in the years of discussions by the IRD Committee. It was apparent that pneumatic-flow resistance was analogous to electrical resistance and it seemed that definitions should be similar. However, pneumatic circuits are usually nonlinear. That property termed "resistance" was quite naturally recognized as the rate of change of pressure drop with respect to flow, the slope of a line, differing from point to point.

The AIEE Standard Electrical Terms defined resistance as the ratio of potential drop to current. This is correct for a linear element but for a nonlinear one it has quite different significance from the derivative at a specific point. Had AIEE terminologists in those early years given adequate consideration to nonlinear elements their definition would doubtless have been influenced thereby. Their concept might have been more universal.

There is unexpected interest and value in the writing of definitions. Definition gives understanding. Those who compose definitions develop understanding. They also have opportunities to support their pet words and thus to avoid being frustrated by terminology committees who declare that something else should be said! As one who has enjoyed working with the author and his collaborators in developing terminology the writer can honestly urge all those engineers who can write to offer their services and to get into the game.

T. J. Higgins.[5] The writer finds himself in complete agreement with the author's remarks and in complete sympathy with his pleas.

The author's remark, "If the reader is stimulated to lend a hand to the integration of concepts, the author's purpose will have been accomplished," spurred the writer to reread the tentative definitions of terms advanced in "Frequency Response Design Criteria and Standards for Data Presentation," as presented at the Annual Meeting of the ASME in New York, in December, 1953.

He found, confirmative of his recollections, that certain of these definitions deviate widely from already well-established definitions as employed by electrical engineers active in servomechanism and automatic-control theory. Accordingly, he urges that the mentioned definitions—and others stemming from previous, current, and subsequent work by nonelectrical groups—be compared with those now employed in electrical-engineering circles; for as therein the state of the theory of control and regulations is, in general, far in advance of its current state in mechanical-engineering and chemical-engineering circles, it would seem that definitions firmly established by the former could well be taken over wholeheartedly by the latter.

J. B. McMahon.[6] The paper is a well-thought-out presenta-

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[5] Professor of Electrical Engineering, University of Wisconsin, Madison, Wis.

[6] Manufacturers Representative and Consulting Engineer, Chicago, Ill. Mem. ASME.

tion of a logical approach to the establishment of a terminology in any field. It need not be restricted to that of instrumentation.

There are two points which occur to the writer that might be emphasized more strongly than has been done by the author.

The first is that any definition to be useful must be both inclusive and exclusive. It must include the essentials of the term and also must automatically exclude other uses, which lead to ambiguities. He mentions the term "sensitivity," which has been badly abused by not having been subjected to this treatment.

The second point is that when definitions are phrased to be both inclusive and exclusive, they are apt to sound stiff and stilted. In this respect they become like laws, which are subject to the same qualifications, and on that account sound a trifle queer to lay ears. A long experience in working with the Automatic Control Terminology Committee of ASME has convinced the writer that there is no escape from this situation. If definitions are to be accurate enough for use in purchase specifications, for instance, they probably will be too rigorous for use in casual conversation.

While on that subject, is there any objection to the use of the single word "Instrumentation" in place of the double expression "Measurement and Control?" Is it felt that "Instrumentation" is the art of applying "Measurement and Control," or that "Instrumentation" is an assemblage of equipment? Certainly here is a place where a good definition could effect a simplification which would be helpful.

Author's Closure

Each of the discussers has effectively supported the idea of concept integration, using a specific example from his own experience. Since the paper was presented, ASA has established Sectional Committee C85 on Automatic Control Terminology. Perhaps concepts will prove their value in integrating the deliberations of C85, whose members represent a wide deversity of academic and industrial backgrounds.