

Technical Committee on Instrumentation and Measurement Technology

1. Objective

The objective is to exchange information by establishing a study group on the advanced frontier measurement technology in the electric and electronic measurement fields. In addition, an investigation expert committee will be established to investigate the present status and future trends.

2. Fields of activity

The field of activity is the academic scope of measurement technology. This includes the most recent significant developments, such as ultrahigh-speed electronic measurement essential for the study of discharge phenomena, electromagnetic field measurement related to electromagnetic environment problems, application of optical measurement and optical technology to electronic measurement, application of high-precision electronic application measurement to moving body communication of frequency and time, biometric application for aging society welfare, and application of magnetic measurement to magnetic sensors.

(1) Application of ultrahigh-speed A/D converters to electronic measurement

The most important technique for ultrahigh-speed electronic measurement is A/D conversion, which is being increasingly studied by academic societies. Advances in high-speed and high-resolution A/D conversion technology may enable the use of various software-based measurement techniques, such as software-defined radio in the communication field.

(2) Identification of the causes of unnecessary electromagnetic wave generation and countermeasures

There are still many problems to be solved in the measurement of electromagnetic waves radiated into space, and it seems that this may be a frontier for the electric and electronic measurement field. Although the measurement of sinusoidal time-varying electromagnetic fields has been previously studied, the unnecessary electromagnetic waves radiated from information processing equipment, e.g., have a complicated waveform, and waveform measurement of the electromagnetic field will be an important future issue. Waveform measurement of electromagnetic fields can be employed to study electromagnetic fields in which discharge phenomena, e.g., electrostatic discharge, occur.

(3) Advancement of optical measurement techniques

With the recent development of optical communication, optical measurement has become an important topic. For basic optical and electronic measuring instruments, such as optical power meters and optical spectrum analyzers, high-performance versions are commercially available. However, the development of measuring technologies and measuring instruments for ultra-high-speed transmission, optical wavelength multiplexing transmission, long-distance transmission using optical amplifiers, etc. is necessary, and active research is being conducted for this objective. For example, an optical oscilloscope that performs equivalent time sampling using an optical mixer without converting fast pulse signals of light into electrical signals has been developed. This device can successfully perform 1 ps (1 THz) optical sampling, and 40 Gbps high-speed transmission is expected in future.

(4) More accurate frequency and time measurement

In frequency measurement, a high accuracy of 10^{-10} has been obtained as a frequency reference for wavelength division multiplexing (WDM) using a 1.5- μm band optical fiber. Although this accuracy is sufficient for wavelength division multiplexed communication, an accuracy of 10^{-11} – 10^{-10} is desirable as the optical frequency reference for weights and measures.

(5) Identification and removal of the causes of "ambiguity" for the standardization of basic electrical quantities

In recent times, there has been an active shift toward mutual international certification of product measurement and evaluation results stemming from globalized and borderless economic activity. Reliable measurement standards need to be established to address this situation.

(6) Advancement of biometric technology for Society 5.0

At present, Society 5.0 is advocated as an ideal future-oriented society. To realize Society 5.0, fields such as ergonomics and HCI, which clarify the relationships, interactions, and psychophysiological relationships between humans and computers, are being actively researched. As biometry forms the basis of these research fields, rapid progress in the research and development of biometrics technology is desired.

(7) Other sensor-based measurement techniques, remote sensing, etc.

3. Activity content

Technical committee meetings and secretariat: four times a year

Technical Meetings: five to six times a year

Field trips: one to two times a year

Investigation committees are established as appropriate by the technical committee based on selected themes.

4. Introduction to activities

Technical Meeting themes: Electromagnetic wave measurement, biometry, optical application measurement, temperature measurement, and general measurement

Field trip: Kyoto University Center for iPS Cell Research and Application (2019), National Institute of Information and Communications Technology (2018), and Hamamatsu Photonics, K.K. (2017)

Investigation Committees

(2013-2015) Investigation Committee on Smart Grid Weighing Traceability

(2015-2018) Investigation Committee on Non-Destructive Inspection Techniques
Using Terahertz Waves

5. Committee members

| Position | Name | Affiliation |
|---------------------|--------------------|--|
| Chairperson | Hajime Nakajima | Fukuyama University |
| Vice-chairperson | Tatsuji Yamada | National Institute of Advanced Industrial Science and Technology |
| Primary member | Jin Inoue | Mitsubishi Electric Corporation |
| " | Takashi Kawamura | Anritsu Corporation |
| " | Syuji Sayama | National Defense Academy of Japan |
| " | Hisao Fukumoto | Saga University |
| " | Katsumi Fujii | National Institute of Information and Communications Technology |
| " | Norikazu Fuse | Central Research Institute of Electric Power Industry |
| " | Taiyo Matsumura | Nihon University |
| " | Tota Mizuno | The University of Electro-Communications |
| Secretary | Takeshi Imatake | Nihon University |
| " | Yoshitaka Sakumoto | Nihon University |
| Assistant secretary | Kazuaki Kodaira | Japan Electric Meters Inspection Corporation |
| " | Terumitsu Shirai | - |

(October 31st, 2021)