

# Technical Committee on Electromagnetic Theory

## 1. Objective

Electromagnetic field theory is an academic field that provides a vital foundation for electricity-related engineering disciplines, including electrical engineering, electronic engineering, and information and communication engineering. In fact, almost all the current devices and systems use technology based on electromagnetic phenomena; electromagnetic field theory is the most prominent basis for devising, developing, analyzing, and designing such devices or systems. Moreover, this theory plays an important role in understanding the interaction between electromagnetic fields and various media and when evaluating the effects of electromagnetic phenomena on environments and living organisms. In several other areas, we benefit significantly from electromagnetic field theory.

A recent notable trend is the attention in several electricity-related engineering fields toward computer-based numerical analysis and simulation techniques for electromagnetic fields. In response, we must proactively support the development of computer-based techniques and provide a firm foundation for these techniques with regard to electromagnetic field theory; this will ensure that they can be applied effectively to address electrical engineering issues. This is because there is often a tendency to rely overly on existing computational software and ignore assumptions and limitations, or the underlying physical phenomena based on which the software was built. This point must be vigilantly broadcast and extensively promoted.

Although researchers and engineers in our country have remarkably contributed to the study of electromagnetic field theory, we would like to contribute further by promoting exchanges between researchers and engineers in Japan and abroad, through various Technical Meetings, joint research, and international conferences. We also strive to foster the next generation of researchers and engineers that can lead the world.

With this intent, the Technical Committee on Electromagnetic Theory aims to conduct the following activities:

- [1] Systematize electromagnetic field theoretical research
- [2] Promote exchange among various electricity-related engineering fields where electromagnetic field theory is used
- [3] Provide information and knowledge to IEEJ members and undertake PR and awareness-raising activities on related technologies for the general public
- [4] Ensure mutual improvement through exchange between researchers and engineers in Japan and abroad through Technical Meetings, joint research, international conferences, etc.
- [5] Stimulate education on related technology and train next-generation researchers and engineers

## **2. Fields of activity**

The Technical Committee on Electromagnetic Theory covers a wide range of fields related to electromagnetic fields and presents research on the themes below, which include basic theories, numerical calculations, applied technologies, and experiments and developments for practical use. It provides a setting for cross-disciplinary exchange among researchers, stretching across physics fields such as electromagnetism and optics and engineering fields such as communication and measurement.

- [1] Basic electromagnetic field theories (including relativity and quantum electrodynamics)
- [2] Electromagnetic field analysis theories
- [3] Electromagnetic field numerical solution methods and numerical modeling
- [4] Electromagnetic field simulation techniques
- [5] Electromagnetic wave scattering and diffraction
- [6] Interaction between electromagnetic fields and media (including lasers, plasmas, and random media)
- [7] Nonlinear problems
- [8] Inverse problems and inverse scattering
- [9] Electromagnetic environments
- [10] Effects of electromagnetic fields on living organisms
- [11] Others

## **3. Activity content**

The Technical Committee on Electromagnetic Theory is carrying out the following tasks:

- [1] Organizing Technical Committee meetings (three times a year)
- [2] Establishing investigation committees
- [3] Convening Technical Meetings (four times a year)
- [4] Exchanges with other academic societies and international exchanges
  - Domestic: IEICE, URSI domestic subcommittee, etc.
  - Overseas: IEEE, URSI, PIERS, OFSET, etc.

The Technical Committee on Electromagnetic Theory has been established in conjunction with the IEEJ and IEICE and holds joint technical committee and Technical Meetings at both academic societies.

## **4. Introduction to activities**

We shall introduce the electromagnetic field theory symposium as a typical activity. This study group meets every autumn for two nights and three days in scenic locations, e.g., the hot springs in Takeo, Minami, Tendo, Nanki-Shirahama, or Miyazaki and will be meeting for the 50th time in 2021 (although online, as it did in 2020). Exciting presentations of research results are made, ranging from

40 to 50 at a time. In addition, this symposium regularly plans on inviting eminent researchers and engineers as speakers for special lectures.

## **5. Expected effects**

Through the activities of the Electromagnetic Field Theory Technical Committee, we expect the following effects.

- [1] Promotion of exchange between different fields of electricity-related engineering
- [2] Promotion of new technologies and new system development
- [3] Increased number of academic conference presentations and published papers
- [4] Promotion of international exchange
- [5] Increased public interest in related technologies and invigorated education

## **6. Committee members**

<b>Position</b>	<b>Name</b>	<b>Affiliation</b>
Chairperson	Akira Matsushima	Kumamoto University
Primary member	Takuji Arima	Tokyo University of Agriculture and Technology
"	Hiroshi Isakari	Keio University
"	Kenichi Ishida	Kyushu Sangyo University
"	Yoshio Iwasawa	Mitsubishi Electric Corporation
"	Tetsuya Ueda	Kyoto Institute of Technology
"	Ryosuke Ozaki	Nihon University
"	Keiji Goto	National Defense Academy of Japan
"	Takuya Sakamoto	Kyoto University
"	Kengo Sugahara	Kindai University
"	Hirohide Serizawa	National Institute of Technology (KOSEN), Numazu College
"	Masahiro Tanaka	Gifu University
"	Hiroyuki Deguchi	Doshisha University
"	Kiyotaka Fujisaki	Fukuoka Institute of Technology
Secretary	Hideki Kawaguchi	Muroran Institute of Technology
"	Yukihisa Suzuki	Tokyo Metropolitan University
Assistant secretary	Junichiro Sugisaka	Kitami Institute of Technology

(October 31st, 2021)