Newsletter

Issued on October 10, 2018 No.23

IEEE Tokyo Section
Life Members Affinity Group

In this issue, three lecture meetings, a study tour on a milestone, and the participation report in Region 10 SYWL Congress are reported.

1. Lecture Meetings

1.1 Lecture Meeting on "Renewable energy: Light and Shade"

This lecture meeting sponsored by LMAG-Tokyo and cosponsored by TPC of IEEE Tokyo Section, IEICE: The Institute of Electronics, Information and Communication Engineers, and IEEJ: The Institute of Electrical Engineers of Japan was held at 13:00-17:00 on Thursday, July 5, 2018, at Kikai Shinko Kaikan, B3, Room Kenshu1 with 42 participants. Lecturer was Prof. Hiroshi Suzuki with Japan University of Economics.

Prof. Suzuki is engaged in R&D of the electric power system. He worked with Mitsubishi Electric Corporation and then GE Corporation.

He began to introduce the New Strategic Energy Plan by Japanese Government, in which the reduction of energy consumption was important and the target reduction of 30% would be realized in 2030. Especially, for the primary energy supply, the ratio of the renewable energy will be 13-14% which is larger than the atomic energy. To promote the renewable energy, power electric companies are obliged to purchase the generated electric energy according to the Feed-in Tariff: FiT, however this FiT is descending recently.

The renewable energies consist of solar energy, wind power, bio mass power, geothermal power, hydroelectric power, and marine power. About 40 years ago, Sunshine Project started, for example, at the Nio town in Kagawa prefecture, but it ceased now.

The most familiar one is the Solar Cell Power. Mega solar stations were constructed more and more in many districts of Japan. The key issue of the solar cell is to obtain the power conversion efficiency more than 20%. The major production companies of solar cells are now in China and Germany. Japanese companies were once in top groups but lost the position in these days.

The wind power generation has been developed, and this power station was constructed in the ocean such as Black Sea where the environment problems did not arise. This power station causes following problems: the fluctuation in the output power, the treatment of the surplus power, and the control of the voltage increase.

The merits of the biomass power generation are the stable output and the carbon neutrality, because every plant absorbs the carbon dioxide gas. The geothermal power has been developed not only for the electric power supply but for the heating. The region near the sky tree area in Tokyo utilized the geothermal power in order to heat buildings and houses.

The hydroelectric power generation has changed from the construction of huge dams to that of small dams. The pumped storage power station utilizes the surplus energy at the night time generated by the thermal power station in order to pump up the water to the dam site.

The marine power generation consists of the wave power, the ocean current power and the temperature difference.

The distribution voltage of the electric power to user sites is to increase the voltage for the reduction of the carbon dioxide gas emission. The present distribution voltage is 100V and/or 200V, but in the near future, this voltage will be 230V and/or 3-phase 400V. For its practical use, new transformers on the electric pole should be investigated

After the lecture, many questions arose from the floors, and all participants enjoyed discussions and comments.

Fig.1 Prof. Suzuki giving his lecture.

1.2 Lecture Meeting on “Radar Measurement of Precipitation from Space”

This lecture meeting sponsored by TPC of IEEE Tokyo Section and cosponsored by LMAG-Tokyo TPC was held on Monday, July 9, 2018, at Kikai-shinko Kaikan with 26 participants. Lecturer was Dr. Toshio Iguchi, NICT.

Dr. Iguchi has been involved in research on

remote sensing technology using radio waves since joining the Communications Research Laboratory, the Ministry of Posts and Telecommunications, currently NICT (the National Institute of Information and Communications Technology). He has been leading the observation of the three-dimensional structure of precipitation from satellites of TRMM (Tropical Rainfall Measuring Mission) and GPM (Global Precipitation Measurement) mission. In this lecture, he presented about Precipitation Radar (PR) technologies onboard satellites, and the contributions to the global weather observation as are following.

TRMM satellite was launched by H-II rocket No.6 from the Tanegashima Space Center on November 28, 1997 as a joint satellite mission of JAXA/NICT in Japan and NASA in US. Although the observation area of this satellite was limited to the tropical zone (the latitude was on the equator side from ± 38 degrees), it gathered global weather observation data and made the great contribution to the advancement of oceanography and meteorology such as elucidation of the El Niño phenomenon. The design life of the TRMM satellite was three years, but the observation continued steadily far beyond the design life, until the operation was completed in April 2015.

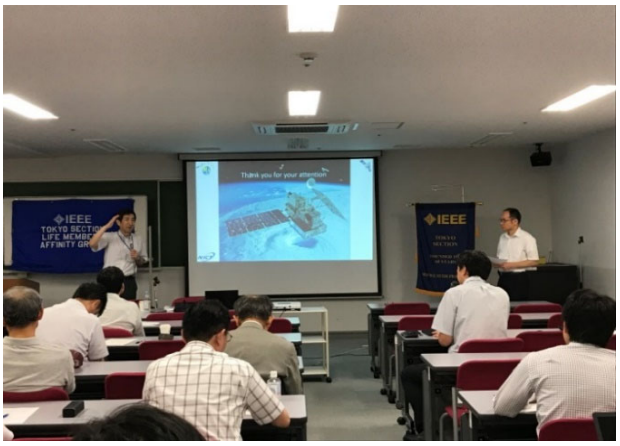

Fig.2 Dr. Iguchi giving his lecture.

Dr. Iguchi developed an algorithm to estimate the three-dimensional precipitation distribution with high accuracy from the observation data of PR. By processing the data using this algorithm, it became possible to accurately grasp the three-dimensional distribution structure of precipitation in ocean and undeveloped areas where weather observation was impossible until then. The precipitation distribution estimation algorithm uses SRT (Surface Reference Technique) that utilizes the difference in apparent surface echo between the rainy and non-rainy regions observed by the radar, but It is necessary to correct precisely the complicated factors for the attenuation of the echo.

By using these data of precipitation observation, it was able to deepen understanding rainfall mechanism in tropical and subtropical regions, along with improving the accuracy of typhoon/hurricane's track forecast as well as daily weather forecast. In addition, new knowledge was obtained in the mechanism of the El Niño/La Niña phenomenon which is a global weather phenomenon.

Following the success of precipitation observation by TRMM satellite as a joint US-Japan mission, the GPM main satellite was launched as the successor of TRMM on February 28, 2014. Until the operation of the TRMM satellite was completed, simultaneous observations were made with these two satellites. The GPM main satellite was developed by Japan and US, which was equipped with two observation devices. One was the dual frequency precipitation radar (DPR) developed by Japan, the other was the microwave radiometer (GMI: GPM Microwave Imager) developed by US. DPR added a radar of 35.5 GHz in addition to a radar of 13.6 GHz which is the successor to the rain radar mounted on the TRMM satellite, which makes it possible to observe precipitation with high sensitivity and high precision. The orbit inclination angle of the GPM main satellite is 65 degrees, which covers observation areas not only tropical but also middle and high latitudes. By making the solar asynchronous, it captures the day change of precipitation. The GMI is also the successor to the microwave radiometer mounted on the TRMM satellite and has additional four new observation channels in 166 GHz band and 183 GHz band in addition to the nine observation channels of the radiometer of TRMM.

At the end of the lecture, Dr. Iguchi touched on other characteristics of radar observation from space, and the future radar for the precipitation observation was mentioned. This lecture was very useful for understanding the space radar technology realizing the ocean's weather data collection which is contributing to improve the accuracy of the weather forecast recently. This lecture was highly satisfying for the participants.

1.3 Lecture Meeting on "Integrated nano-photonics using photonic crystals"

The above-mentioned Tokyo Section lecture meeting was held by TPC with co-sponsorship of LMAG on September 6, Thursday, from 15:00 to 17:00 at Room B2-1 of Kikaishinko Kaikan. The participants were 18 in number. The lecturer was Dr. Masaya Notomi who was the senior fellow researcher of NTT Laboratories and a professor of the Physics Department of Tokyo Institute of Technology.

At first, he explained about photonic crystals and integrated photonics. Photonic crystals are artificial periodic structure of refractive index which is realized with nano-processing technology. Those enable to apply bend theory in solid material physics to optics.

By integrating those, various interesting characteristics were realized that usual natural materials cannot afford.

Next, concrete research results were introduced. It was shown that peculiar phenomena such as negative refractive index and slow light occurred with photonic crystals. Applying strongly confirmed light caused by photonic band gap, various ultra-small optical devices were investigated. Those devices drastically reduce the energy consumption than conventional optical devices so that he esteem and are eventually promising as optical integration technique in the future.

Fig.3 Dr. Masaya Notomi delivering his talk.

Lastly, he told about the direction of the future research: the possibilities of the fusion of nano-materials and nano-photonics, computing based on the fusion of light and electron, and optical application of topological properties. Those technologies enable the ultra-low energy consumption and ultra-fast speed of information processing.

After the lecture, there was time of Q&A. The audience made 4 questions that encouraged active discussion.

2. The participation report in Region 10 SYWL Congress 2018 by Vice Chair T. Takano

The congress was held on August 30, Thursday, to September 2, Sunday, at Prime Plaza Hotel Sanur-Bali on Bali Island, Indonesia. This is a joint meeting of the affinity groups of Students (S), Young Professionals (YP), Women in Engineering (WIE) and Life Member (LM). Originally, T. Miki Chair planned to attend it, but due to his inconvenience, I was suddenly asked to do so.

There was no public transportation from Denpasar Airport, the entrance to Bali Island, to the hotel of the venue so that I had to use taxi. In the mid night, taxi drivers requested a higher fee. I got the normal value after negotiation, felt anxious till the arrival at the termination. When I arrived, the reception almost closed.

The next day, in the morning, there was held a plenary session, where they had addresses and speeches by several key persons including IEEE President. Later in the morning, a session was held by each Affinity Group. I attended the LMAG session to present our activity with the title "Activities of LMAG-Tokyo in Japan". Besides, there were presentations to introduce the Life Member activities in India and Indonesia, and we had panel discussion with representative of each LMAG. It was clarified that they had no LMAG in Indonesia, but would endeavor to establish it. Then, the session Chair and R10 LM Coordinator Aoyama introduced TENCON in Korea so that the Korean representative explained in detail of the conference.

In the afternoon, I attended to WIE session to speak in support of the representative of WIE Japan Yano from the standpoint of LMAG. First, I told my experience in the conference in Japan where I relaxed the criteria of woman session chairs to get a great success. This eventually offered a discussion topic. Next, I explained the comparison table between WIE and LMAG, and attended the following panel discussion.

Fig.4 Prof. Takano delivering his talk in WIE session.

Fig.5 Recognized YP Japan. The third from left is IEEE President Jim Jefferies.

In the evening, there was a pleasant session with banquet, addresses, commendations and entertainments. Several awardees were introduced: Bangladesh got the most awards, and Malaysia and Japan followed next.

Fig.6 Group photo taken at the banquet end

3. Technical Tour to IEEE Milestone Recipient

LMAG-Tokyo held the Technical Tour to Nobe-yama 45 meter Radio Telescope which was recognized as an IEEE Milestone in 2017. This tour was cosponsored by History Committee and TPC of IEEE Tokyo Section, and cooperated by Shin-etsu Section as the location, Nobeyama, Minamimaki, Nagano prefecture was in their territory.

It unluckily rained. The participants who were 18 in number more than expected in spite of a far distance, gathered in the main building of Nobeyama Radio Observatory at 13:30, September 20, 2018.

The opening was at 14:00. After the address by Chair Miki, the director of Radio Observatory and a professor of National Astronomical Observatory Ken-ichi Tatematsu made a presentation entitled "The figure of space clarified by Nobeyama 45 meter Radio Telescope". With an excellent narration, he explained the configuration of the Radio Telescope and the characteristics of radio waves to be measured. Its characteristics were simply clarified in comparison with Hubble telescope and Subaru telescope.

Successively, he introduced ALMA （Atacama Large Millimeter/submillimeter Array ） Radio Telescope in Chile which he was deeply involved in its construction. The ALMA antenna constitution with 66 elements and its characteristics as well as Atacama Desert were explained. In particular, the meanings of various frequencies from radio wave, light, X-ray and gamma ray were explained from astronomical point of view, which attracted IEEE members. Meanwhile, he told everywhere his experiences and chats to arouse the laugh in audience.

At 15:30, they moved in the rain to facility tour under the guidance of the director and an observatory member Mikoshiba. First, the participants enjoyed the outlook of 45 meter Radio Telescope, and the visit to the room for measurement and operation. This Radio Telescope was completed in 1982, being the world biggest with a parabola of 45 diameter and the weight of 700 ton, and enables the observation at mm wavelength up to 150 GHz for the first time in the world. The requested reflector precision for the observation at this frequency band is 0.1 mm that is almost equal to the diameter of a head hair, as impressed the all members. Being inclined, the reflector suffers from distortion, which is compensated by a clever technique called homology. This technique was developed by Mitsubishi Electric Co., and also used in ALMA Radio Telescope.

The requested reflector precision for the measurement at this frequency is 0.1 mm that is almost equal to the diameter of a head hair, as impressed the all members. Being inclined, the reflector suffers from distortion, which is compensated by a clever technique called homology. This technique was developed by Mitsubishi Electric Co., and also used in ALMA Radio Telescope.

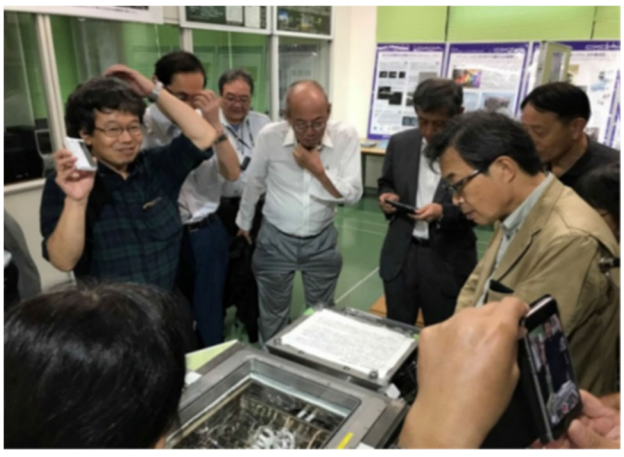

Fig.7 Study on the historical change of millimeter receivers.

Measurement in mm wavelength is limited in the season from autumn to winter due to the attenuation and fluctuation by moisture in the air, and wind velocity less than 10 m due to reflector distortion. These measurement conditions interested the members. For operation, the receiving procedure

and data processing are needed so that receiving instruments at mm wavelength have been innovated according to technology progress. The historical change of the instruments was also interesting to the members.

Then, they moved to see the mm wavelength interferometer and a heliograph. These are arrays of small antennas, and look marvelous. They saw the antenna array and 45 meter Radio Telescope simultaneously at a particular point, as was a good view for Instagram.

Fig.8 Simultaneous view of 45 meter Radio Telescope and a heliograph antenna array

Lastly, they had a tour in the exhibition room of National Institutes of Natural Sciences, which includes National Institute for Fusion Science, Institute for Molecular Science, National Institute for Basic Biology etc. as well as National Astronomical Observatory. There were displayed actual millimeter receivers in time sequence, which were the central part of 45 meter Radio Telescope. The director explained the measurements made in his youth in detail and with humors.

Then, they moved to the outdoor explanation for the principle of a parabola antenna. But it was almost the closing time so that they had a group photo and closed the tour.

From 17:30, a social gathering was held outside the observatory. The participants were 15, and told the impression of the tour and questions. In return, the director clarified his sufferings in managing the observatory. It was very meaningful time. Closing at 19:30, some members returned home and the others went to the lodge in the observatory to stay in favor of the director.

Fig.9 Group photo with millimeter interferometer. The second left from Chair Miki holding the IEEE flag is Dr. Tatematsu, and the right most in the front line is Mr. Mikoshiba.

4. Near Future Events

The following events are planned. The details will be informed by e-mail. Your participation is encouraged.

6-1 TOWERS Lecture Meeting
Date: November 3, 2018, Thursday.
Place: Keio University

6-2 Technical Tour
Date: December 25, 2018, Tuesday.
Place: Japan Automobile Research Institute (JARI)

IEEE Tokyo Section LMAG Newsletter, No. 23
Issued on October 10, 2018
Issued by IEEE Tokyo Section Life Members Affinity Group
Kikai-Shinko-Kaikan Bldg., 517
3-5-8 Shibakoen, Minato-ku, Tokyo 105-0011 JAPAN
URL: http://www.ieee-jp.org/section/tokyo/lmag/index.htm
E-Mail: tokyosec@ieee-jp.org