

Citation

Conception of Dynamic Single-Mode Semiconductor Lasers and Pioneering Research on Long-Distance and High-Speed Optical Fiber Communications



Dr. Yasuharu Suematsu

Position and Organization:

Adviser and Professor Emeritus (Former President), National Institute of Informatics
 Professor Emeritus (Former President), Tokyo Institute of Technology
 Professor Emeritus (Former President), Kochi University of Technology

Doctorate : Doctor of Engineering (Tokyo Institute of Technology, 1960)

Date of Birth : September 22, 1932

Brief Biography :

- 1955 B.E., Tokyo Institute of Technology
- 1960 Dr. Eng., Tokyo Institute of Technology
- 1960 Research Associate, Tokyo Institute of Technology
- 1961 Associate Professor, Tokyo Institute of Technology
- 1973 Professor, Tokyo Institute of Technology
- 1987 Dean, Faculty of Engineering, Tokyo Institute of Technology
- 1989 President, Tokyo Institute of Technology
- 1993 Professor Emeritus, Tokyo Institute of Technology
- 1994 Auditor, Japan Society for the Promotion of Science
- 1995 Director-General, National Institute for Advanced Interdisciplinary Research Laboratory
- 1997 President, Kochi University of Technology
- 2001 Professor Emeritus, Kochi University of Technology
- 2001 Director-General, National Institute of Informatics
- 2001 Chairman, Council for Science and Technology, Ministry of Education, Sports, Culture, Science and Technology
- 2005 Adviser and Professor Emeritus, National Institute of Informatics

- 1992 President, Institute of Electronics, Information and Communication Engineers
- 2001 Chairman, Institute of Image Information and Television Engineers
 (Honorary Ph. D, University of Maryland
 Honorary Ph. D, Surrey University)

Main Awards and Honors :

- 1982 IEEE/LEOS Quantum Electronics Award
- 1983 Valdemar Paulsen Gold Medal, Danish Academy of Technical Sciences
- 1983 Japanese Prime Minister's Award for Contribution to Communication
- 1986 IEEE David Sarnoff Award
- 1989 Toray Science and Technology Prize
- 1993 IEEE/OSA John Tyndall Award
- 1994 NHK Distinguished Award for Broadcasting Culture
- 1994 C&C Prize, Foundation for C&C Promotion
- 1996 Purple Ribbon Medal, Japanese Government
- 1996 Eduard Rhein Basic Research Prize
- 2003 IEEE James H. Mulligan, Jr. Education Medal
- 2003 The Cultural Merit Award
- 2006 The Order of the Sacred Treasure, Gold and Silver Star

- 1993 Foreign Member, National Academy of Engineering, USA
- 1997 IEEE Life Fellow

and many others

Main Achievements :

Dr. Yasuharu Suematsu has carried out research on optical communications since the time when optical electronics was still in its infancy. The scope of his researches include the suitability of semiconductor lasers modulated at high speed as light sources for optical communications, and the wide-band characteristics of optical fiber used as a transmission medium.

Having pursued from the start the implementation of long-distance, high-speed optical fiber transmission, Dr. Suematsu and his fellow researchers in 1979 became the first in the world to achieve continuous operation at room temperature of a long-wavelength semiconductor laser. They chose as the laser material GaInAsP (Gallium Indium Arsenide Phosphide), whose potential for long wavelength oscillation they were attempting to achieve, as well as the crystal growth method and other characteristics, had yet to be fully demonstrated. For the first time anywhere, they were able to achieve semiconductor laser oscillation in the 1.5 micron band. However, he pointed out, although silica fiber exhibits the smallest propagation loss in the 1.5 micron band, the lack of technology for overcoming the large material dispersion in this band stood in the way of its implementation for long-distance, high-speed transmission.

On the assumption that the dispersion issue could be solved by limiting the oscillating modes of the semiconductor laser itself, Dr. Suematsu decided to take up the difficult challenge of building a semiconductor laser whose wavelength purity and precision remained unchanged even under rapid modulation or when the ambient temperature changed. The name given to such a laser was dynamic-single-mode (DSM) laser (1980).

Toward its implementation, around 1975 he invented an integrated twin-guide laser as a new kind of single-mode semiconductor laser. Based on the totally new concept of selective oscillation of one wavelength based on optical interference between the active layer and nearby waveguide, the effectiveness of this laser was first demonstrated theoretically. Then in 1980, it was implemented as a high-performance long-wave device with distributed reflector. The development of a laser that maintained mode purity even under rapid modulation in the Gigahertz range was highly acclaimed at international conferences and elsewhere.

Anticipating future needs, in 1983 he developed the world's first tunable semiconductor laser in which the wavelength is electronically adjustable, as an essential device for realizing ultra wide-band optical communications. This development ended up paving the way for the terabit-per-second wavelength division multiplexing (WDM) optical networks that became common by the end of the 20th century.

As awareness of this innovative technology grew, it occasioned the development of various devices, and became the basis for the widespread availability of high-capacity optical fiber communications today. It was a realization of the concept of integrating functions on a single device rather than using individual laser diodes.

His pioneering and on-going research and development efforts, particularly in realizing the dynamic-single-mode semiconductor laser, have contributed enormously to the implementation of long-distance and high-speed optical fiber communications, and have brought him numerous awards and honors in Japan and abroad, as noted above. Moreover, he has devoted himself in countless ways to the advancement of university education and scientific research, training the next generation of researchers and supporting science education in general. Among his contributions in these areas, he has served as president of two universities, Tokyo Institute of Technology and Kochi University of Technology, and has headed such organizations as National Institute for Advanced Interdisciplinary Research Laboratory, National Institute of Informatics, and the Council for Science and Technology. In recognition of his distinguished accomplishments, he was awarded as a person of Cultural Merits in 2003, and the Order of the Sacred Treasure, Gold and Silver Star, in autumn 2006. For his truly remarkable achievements on all fronts, and for his outstanding contributions to society, Dr. Yasuharu Suematsu is hereby awarded the Okawa Prize.

Dr. Suematsu and Mrs. Suematsu have two sons and are enjoying history research and stone collection.