FOREWORD

Special Section on Frontiers of Superconductive Electronics

Superconductive electronics opened in 1962, the year of the discovery of the Josephson Effects. Throughout the history of about 50 years, research fields of superconductive electronics concentrate on highly sensitive magnetic sensors called SQUIDs, low noise mixers for radio astronomy, voltage standards, and high-speed digital circuits with ultra low power consumption. Although these active devices are based on low transition temperature superconductors, they are special to superconductive electronics and have exclusively high advantage to competitive devices. After the discovery of high temperature superconductors (HTSs), passive filters with low insertion loss and with sharp cut-off characteristics were added to the research fields.

In the last decade, remarkable advancement has been achieved in each research field. The SQUID technology has been applied to a variety of academic fields such as medical diagnosis and nondestructive evaluation of structures. In addition, HTS SQUIDs come into practical use because of their compactness and portability. Improved quality of Josephson junctions enables us to detect electromagnetic waves with high frequencies close to 1 THz, and to apply them to a new field concerning THz-wave imagers. As for passive filters, the research topics are shifted from receiver filters to transmitter filters that need to have capability of high power handling. In a digital circuit application, high-speed operation around 100 GHz has been achieved as well as large-scale integration. In addition, establishment of interconnect technology based on electromagnetic waves leads to gaining a remarkable advantage to semiconductor devices.

Besides advancement in usual superconductive technologies mentioned above, several technologies emerged and opened new research fields for the last decade. Transition edge sensors with high energy resolution has been studied and applied to an energy dispersive X-ray fluorescence spectrometer. Superconductor single photon detectors and several types of superconductor qubits have been developed for quantum communication and quantum computing, respectively. Moreover these emerging technologies started to be combined with the forefront of usual superconductive electronics and create a system special to superconductive technologies.

In this Special Section, latest achievements of superconductive electronics are featured. Although all the fields cannot be covered because of the limit of the pages, readers will be able to feel a touch of frontiers of superconductive electronics. On behalf of the editorial committee, I would like to express our great thanks to all the authors of invited and contributed papers submitted to this Special Section and to all reviewers. I expect this Special Section to contribute to further progress in all fields of superconductive electronics.

Finally, I would like to thank all the editorial committee members listed below for their efforts to this editorial work.

Akira Fujimaki, Guest Editor

Akira Fujimaki *(Member)* received his B.E., M.E., and Dr.Eng. degrees from Tohoku University in 1982, 1984, and 1987, respectively. He was a Visiting Assistant Research Engineer at the University of California, Berkeley, in 1987. Since 1988, he has been working on superconductor devices and circuits at the School of Engineering, Nagoya University, Nagoya, Japan, where he is currently a professor. His current research interests include single-flux-quantum circuits and their applications based on low- and high-temperature superconductors.