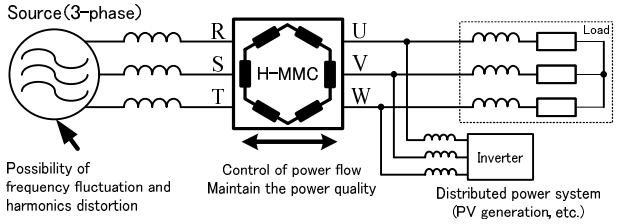
Name	Job Title	Area of Expertise
HAMASAKI Shin-ichi	Associate professor	Power Electronics, Control Engineering

1. Main Research Topics

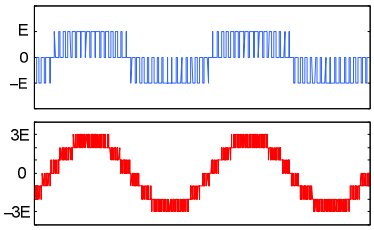
My main research topic is new circuits and control methods for power converters in power electronics, as well as their applications.

① Research on novel power converter system based on modular multi-level converter

The modular multilevel converter (MMC) is a circuit connection in which inverters are modularized into multiple stages. Research and development are currently underway on this technology, which is expected to be next-generation power conversion system that can reduce distortion in voltage waveforms through high voltage and multilevel output. In this research, I am studying the circuits and control of a new power conversion system based on the MMC, as well as its applications. As application examples, I am proposing the power flow controller using the hexagonal MMC (H-MMC) that performs three-phase AC-AC conversion to manage power transmission in the power grid, the power conditioner for mega solar power plants that performs DC-AC conversion, and an MMC integrated with a power storage device that can manage power by incorporating a power storage device.



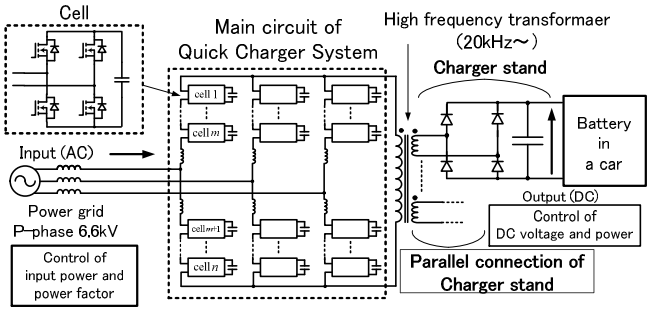
Power flow controller using H-MMC



Multi-level low-distortion voltage waveform

② Research on novel circuit and its control for quick charger system of electric vehicle

Research and development are being conducted on electric vehicle quick chargers to improve their efficiency and size to shorten charging times and popularize charging system infrastructure. In this research, we are researching a new circuit method and its control method that applies MMC as the system that can be expected to improve the efficiency and size of quick charger system. The proposed system supplies power directly from high voltage of 6.6 kV via the transformer, and by handling the large amount of power due to the high voltage, it is possible to manage and operate multiple charging stations as a single system, which is expected to improve efficiency and size.



③ Research on improving performance for power compensation system applying digital control

Power systems are becoming more complex due to the distributed installation of distributed power sources and energy storage devices. To ensure proper power management, various power compensation devices such as reactive power compensators, power flow controllers, and active filters are being researched and developed. In this research, we propose a new control method that applies digital control to the control of these power compensators to speed up response and thereby stabilize the power system to respond to fluctuations in the complex power network.

2. Keywords

Power conversion system, Multi-level converter, Quick charger, Digital control

3. Remarks and Websites

Modular multilevel converters are expected to be power converters capable of handling high voltages and large power, and their applications are diverse. The system proposed in this research is expected to have a wide range of applications in addition to the examples above.

In addition to the multilevel converter circuits shown above, I am also available to consult with you on circuit configurations and control methods, from basic systems using general inverters to applications.

researchmap: https://researchmap.jp/read50176006
Laboratory: https://www.eee.nagasaki-u.ac.jp/labs/asca/