

# **LARGE-CAPACITY INVERTER TECHNOLOGIES AND THEIR APPLICATIONS FOR INDUSTRY AND POWER SYSTEMS**

**Dr. Shinzo Tamai**

**Senior Fellow Power Electronics Systems Division  
Toshiba Mitsubishi-Electric Industrial Systems  
corporation (TMEIC)**

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## **ABSTRACT**

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The power converters have been improved with the development of power semiconductors and control technologies. The development of high-speed switching power semiconductors enhanced the market of voltage source converters in many industrial fields. The control technology development made the complicated circuit topologies practically feasible.

About forty-years ago a three-level inverter was firstly presented by Prof. Nabae, Prof. Takahashi and Prof. Akagi. They presented two types of three-level inverters. One is neutral point clumped (NPC) type, the other is neutral point piloted (NPP) type. First practical application of the three-level inverter is NPC type.

As an application of NPC three-level inverter that the rated capacity is several MW, the 4-MVA motor drive system had been presented and applied to the steel mill drive. According to the improvement of the power semiconductors, the rated power of the inverter has been increased. Several tens of MW, extra-large capacity power inverters for motor drives or for power systems are introduced.

The trend of UPS (Uninterruptible Power Source) circuits are introduced as an application of several hundreds of kVA two-level and three-level converters. The comparison of NPC type and NPP type are discussed. Then, MW-rated PCSs (Power Conditioning Systems) for utility-scale PV power generation plants are introduced as practical examples of NPP type three-level inverter.

Finally, as a future technology trend, the MMC (Modular Multilevel Converter) circuit is introduced.