

## Special Reports

### Building Facilities Supporting Social Infrastructure

#### Building Facilities in the Ubiquitous Era

KATO Takatoshi

#### Technical Trends in Building Facilities

YAMAMOTO Kazumoto / DONEN Nobuyuki / NISHIMURA Nobutaka

Various facilities are installed throughout a building to secure safety and convenience for the occupants. When providing such facilities, it is important to consider global warming, ozone layer depletion, and measures against hazardous substances. In particular, promotion of energy-saving as a measure against global warming is of primary importance.

Building facilities that satisfy these requirements with the aid of information technology will comprise an essential component of social infrastructure in the ubiquitous era.

#### Trends in Electricity Receiving and Transforming Equipment as Building Facilities Lifeline

KIDA Satoshi

Electricity receiving and transforming equipment, which can be considered a lifeline of building facilities, must not only offer high reliability but has also been required to provide environmental friendliness in recent years. As a result, efforts are being made to reduce the energy required for the production of such equipment and to use materials having a low environmental burden. Furthermore, with the introduction of distributed power supply systems such as cogeneration systems and photovoltaic systems in progress, enhancement of engineering at the planning stage is being materialized by the practical application of distributed power supply simulators. These technologies exhibit their effects at the time of equipment renewal, and are contributing to improvement of the effects of renewal.

#### Uninterruptible Power Supply (UPS) –Silent Heart of Building Facilities

MIYABE Takashi / NAGATA Noriaki

With the diffusion of information and communication systems as represented by the Internet, stable operation of computer systems has become a key requirement for the functioning of society. A stable supply of quality power is essential as a firm foundation to support these computer systems. Accordingly, the role of uninterruptible power supply (UPS) systems is becoming increasingly important.

Advanced technologies are also in demand for the downsizing and weight reduction of electrical equipment for buildings, including UPS systems, for the purpose of easy renewal. Moreover, high efficiency, advanced functions, easy maintenance, and low cost are required to ensure the reliability and extensibility of UPS systems as a power source.

Toshiba has developed a highly efficient UPS system to meet these needs and contribute to the reduction of life cycle costs. We are also conducting research and development to further improve the reliability and extensibility of UPS systems.

#### Main Network for Facility Management – BEMS™ and Energy-Saving Control

SAITO Sadatoshi

Concern about energy saving has recently been increasing rapidly in recognition of the serious environmental issue of global warming. As the need for energy saving in building facilities becomes more important, BEMS™ (Building and Energy Management System) – a main network for facility management—plays an essential role in achieving significant energy - saving effects.

Toshiba has constructed a new BEMS™ that realizes further energy savings through the adoption of new technologies including comfortable air conditioning, open network technology, and radio technology.

#### Energy-Saving Control for Office Lighting

MORIMOTO Yasushi / OTA Masaaki

Lighting control systems have been introduced in buildings in many cases for energy-saving purposes. In recent years, however, not only energy saving but also favorable effects on the visual environment are desired by users. In addition, lighting control systems are required to flexibly respond to control system changes associated with changes in office layout.

Toshiba Lighting & Technology Corp. has developed a new lighting control system and supplied it to the Nippon Television Tower of Nippon Television Network Corp. This system has newly introduced "lighting modules" consisting of a brightness detection sensor and an occupation sensor to secure fine lighting control, energy-saving control, and adaptability to layout changes. Moreover, the system incorporates a function to calculate lighting power from the state of lighting control, which furnishes power consumption data for building management to confirm energy-saving effects.

#### "Super Heat Recovery Multisystem" Air Conditioners for Building Use

KIGUCHI Yukio / MAEZAWA Mitsunobu / YAMADA Yoshihiro

There is a great need to develop multisystem air conditioners for buildings, because air conditioners for business use account for a considerable share of overall power demand. Toshiba Carrier Corp. and Chubu Electric Power Co., Inc. were awarded the Energy-Saving Prize in 2003 by the Energy Conservation Center for developing the "Super Module Multi" air conditioners that use hydrofluorocarbon R410A as the refrigerant and incorporate a dual-inverter system.

We have now introduced the "Super Heat Recovery Multisystem" series of air conditioners for building use that can provide cooling and heating functions at the same time.

#### New Type of Elevator for Buildings

OHTSUBO Ryo / TANAKA Kazuhiro / OZAKI Keiji

Toshiba Elevator and Building Systems Corp. has continued to develop new types of elevators since developing and commercializing the SPACEL™ machine-roomless elevator for medium- and low-speed applications, which was the first such product in the industry. Our aim is to increase comfort and convenience for the users while requiring the least possible space in the building.

We have now developed and commercialized another type of small-machine-room elevator, the New ELBRIGHT™, for high-speed applications. Savings in both energy and space have been realized by making the traction machine smaller and the control panel thinner and by adopting a one-side inspection structure for the control panel. As a result, the space required for the machine room is reduced by 38 %. The New ELBRIGHT™ represents a major step forward in the field of high-speed elevators.

#### Security System for Building Management

FUJIMORI Atsushi / KANNO Maiko / TACHIKAWA Kan

Security policy is important for access control in building management. There are two main objectives in applying security policy in building management. One is to secure compatibility of security and the occupants' convenience, for which a personal identification system using facial recognition is effective. The other is to give priority to security over other considerations. For this latter objective, Toshiba proposes not only a specially developed door system that allows only one person to enter at a time, but also a monitoring system that recognizes individual faces and is equipped with a video recording system.

## Feature Articles

#### High-Efficiency Piezoelectric Single Crystals

HOSONO Yasuharu / YAMASHITA Yohachi

Toshiba has developed indium-doped lead magnesium niobate titanate single crystals (Pb(In<sub>1/2</sub>Nb<sub>1/2</sub>)O<sub>3</sub>-Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>; PIMNT) that have outstanding piezoelectric properties and exhibit high Curie temperatures (T<sub>c</sub> > 180 °C). Lead perovskite compounds, such as lead magnesium niobate titanate (Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>; PMNT) and lead zinc niobate titanate (Pb(Zn<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>; PZNT) single crystals, have been investigated for transducer applications over the past 10 years. Although these single crystals have large piezoelectric constants (d<sub>33</sub> > 2,000 pC/N), their T<sub>c</sub> values are relatively low (140-175 °C). These low T<sub>c</sub> values may adversely affect the thermal stability of the piezoelectric properties and their robustness against voltage changes. Therefore, over the past two years or so, new single crystals with higher T<sub>c</sub> such as our PIMNT single crystals have been attracting attention. Various other material systems, including bismuth scandate-lead titanate (BiScO<sub>3</sub>-PbTiO<sub>3</sub>; BPST) and potassium niobate (KNbO<sub>3</sub>; KN) piezoelectric single crystals (PSCs) are also being researched.

#### Small-Sized RF Module for Wireless LAN

HIJURA Shigeru / ISHIDA Masaaki / YAMAMOTO Tetsuya

Wireless stations used in the ubiquitous network are expected to be small in size, cheap in price, and low in power consumption. To meet these requirements, high-density packaging technologies and RF circuit technologies are essential.

Toshiba has applied packaging technologies such as flip chip mounting and build-up substrates to wireless LAN RF modules. We have also optimized the multilayer substrate wiring on the basis of three-dimensional electromagnetic field analysis and developed a technique for embedding passive devices in substrates. Consequently, we have realized a small-sized RF module measuring only 24 mm in height, 32 mm in width, and 2.1 mm in thickness for use in dual-band wireless LAN.

#### FA2100A Series Industrial Computers

AZUMA Takao / TANAKA Shigehiro

Computers have come to be applied in various fields in line with the rapid improvements in their performance. Industrial computers are also widely used in many industrial fields, such as factory control and broadcasting/communications. Users of industrial computers require computers that provide higher reliability and require minimal maintenance.

Toshiba has developed the FA2100A series of small-sized industrial computers. This paper introduces the FA2100A series, the latest addition to our lineup of industrial computers.

#### X-Ray Inspection System Using Color Image Intensifier

NITTOH Koichi / KONAGAI Chikara / NOJI Takashi

Toshiba has successfully developed a multicolor scintillator-based X-ray image intensifier called the Ultimage™, featuring high sensitivity, a wide dynamic range, and long life. A europium-activated Y<sub>2</sub>O<sub>3</sub>S scintillator, emitting red, green, and blue photons of different intensities, is utilized as the output fluorescent screen of the intensifier. By combining this image intensifier with a suitably tuned high-sensitivity color CCD camera, the sensitivity of the red color component was enhanced to six times that of a conventional image intensifier. Simultaneous emission of a moderate green color and a weak blue color also covers different sensitivity regions. This results in a double-digit widening of the dynamic range.

With this image intensifier, it is possible to simultaneously image complex objects having a variety of different X-ray transmissions, ranging from paper, water, and plastic to heavy metals. This color scintillator-based image intensifier is being introduced for X-ray inspections in various fields.

#### Rotary Phase Shifter as Power Compensator for Various Power Source Systems

MIYAZAKI Yasuyuki / KAGEYAMA Takahisa / ISHIZUKI Teruyuki

Utilization of renewable energy resources such as wind power and solar power is of primary importance for solving energy and environmental problems. However, renewable energy resources depend on natural conditions and it is difficult to consider renewable energy plants as constant power sources.

Toshiba has developed a rotary phase shifter in order to promote the diffusion of various power supply systems. This rotary phase shifter is a type of compensator based on rotating machine and system control technologies. A prototype rotary phase shifter was installed in a wind power equipment terminal, and its satisfactory control performance was verified.

#### Three-Axis Turret for Camera Tracking System

NARUMI Noboru / ARAKAWA Kenichi / TOYOSHIMA Takeshi

Surveillance cameras on motor-driven turntables have recently become prevalent in various settings such as security surveillance of important social infrastructure, traffic information gathering in intelligent transport systems (ITS), and so on.

With a wide range of applications in mind, Toshiba has developed a three-axis gimbal-stabilized turret with the following features: (1) rapid and assured angular acquisition and tracking of a target in any relative direction within the hemispherical field of view by utilizing a novel gimbal-control algorithm, (2) extremely stable look-angle pointing accuracy for various vehicle-mountable applications, and (3) agile angle-steering capability for sequential looks at multiple targets in a period short enough to track those targets simultaneously.

#### Quantum Teleportation with a Laser

FUJII Mikio

Quantum teleportation is considered as one of the most important quantum information technologies with high feasibility, and its potential applications range from unconditionally secure communication to a building block for a quantum network or a quantum computer.

In the year 2000, the so-called first demonstration experiment of quantum teleportation with a laser came under severe criticism, which later developed into a controversy that lasted for more than two years. Toshiba Solutions Corp. has solved this long-standing controversy for the first time by formulating the measurement process with a laser on the basis of the quantum theory. We have also made a new proposal for quantum teleportation with plural lasers based on the knowledge obtained from the above-mentioned solution.

#### DWS-60X6 Automatic Dishwasher Using Steam and Concentrated Detergent

KOKETSU Tadaaki / SUGIMOTO Yasuko / YOSHIKAWA Kei

An automatic dishwasher is always rated highly in evaluations of electric home appliances desired by homemakers. Among the reasons mentioned in surveys are "Want to clean dishes hygienically," "Clearing up is troublesome and the family needs the time to get together," and "Want to cut down on water bills." Accordingly, the dishwasher penetration rate in Japanese households now exceeds 10 % and is expected to grow rapidly. Manufacturers are therefore swiftly introducing new models on the market with improvements in the areas of high detergency, compactness and large capacity, and energy-saving performance.

Toshiba released the DWS-60X6 automatic dishwasher in June 2004. This model features high detergency using steam and concentrated detergent, as well as a compact and large-capacity design with a new three-layer basket capable of holding 61 dishes.

## Frontiers of Research & Development

#### High-Speed Tracking Camera System

#### Leading-Edge Nanoparticle Synthesis and Manipulation Technology