

## Special Reports

## Measurement and Control Systems

## Future Expectations for Measurement and Control Systems

MORI Kinya

## Trends in Measurement and Control Systems and Future Outlook

KUSAKABE Hiroyuki / SHIBATA Koji / HARA Hideyuki

Measurement and control systems are widely used in various fields including industrial systems as well as public and other facilities. In response to a broad range of market needs, Toshiba has been developing measurement and control system equipment including supervisory and control systems and components incorporating advanced technologies. Demand has been growing in recent years for improvement of the reliability and safety of these systems in developed countries to construct a safe and secure society, and for reduction of the cost of these systems in developing countries to improve their infrastructures. The recent large-scale earthquake disaster has led to growing awareness that a drastic shift is required from conventional individual system-type energy management to integrated energy management.

As a solution to this issue, we are aiming to realize integrated energy management and improve energy efficiency in the social infrastructure field through the further development of technologies for measurement and control systems constituting social infrastructure systems.

## Energy-Saving and Preventive Maintenance Solutions for Steel Plants

SAKIYAMA Yasuyuki / KUBOTA Kei / HORIKAWA Tokujiro

The Toshiba Group has released the uDB plant information database system, which can save all control and process data transmitted over the TC-net™ 100 high-speed real-time network over a long period, as a support system for the quality control of end products in steel plants. Furthermore, the newly developed TC-net™ 1G information and control network for next-generation control systems, which achieves high-speed data transmission with large-capacity memories, makes it possible to collect a broader range of control and process data in plants compared with conventional systems.

The Toshiba Group is supplying energy-saving solutions and preventive maintenance solutions for large-capacity motors and induction heater control systems of steel plants utilizing the uDB system and TC-net™ 1G.

## Enhancement of Support for On-Site Personnel by Evolution of DCS and Operational Support Systems

KIKUCHI Tadao / KANNARI Tadao / SUGIMORI Hisayoshi

To cope with the drastic changes taking place in the market, ensuring continuous and stable production is a serious issue for many companies. Improvement of the manufacturing environment so as to support workers in realizing high performance has therefore become essential as a solution to this issue.

The Toshiba Group is making efforts to upgrade distributed control systems (DCS) and operational support systems as the core of manufacturing. We have also developed an electronic operation diary that automatically accumulates operational know-how as a replacement for handwritten operation diaries, to improve the ability of on-site personnel to make decisions and resolve problems. We intend to offer a new integrated manufacturing management environment by enhancing DCS and various operational support systems.

## BUILDAC™-U and BUILDAC™-Us Facility Solutions to Realize Comfort and Energy Conservation in Large- to Small-Scale Buildings

YANO Kazunori

Attention is being increasingly focused on energy conservation due to the revision of the Law Concerning the Rational Use of Energy and the implementation of electricity conservation measures as a result of the shortage of power supply capacity following the Great East Japan Earthquake. In response to this situation, although building management systems in large- and medium-scale buildings have been changing from conventional monitoring and control systems to the building energy management system (BEMS) with advanced energy management functionality, demand has also been growing in recent years for BEMS in small-scale buildings.

Toshiba has developed and released BUILDAC™-Us, a BEMS for small-scale buildings, following the development of the BUILDAC™-U BEMS for large- and medium-scale buildings. This makes it possible to offer high-value-added systems that integrate comfort with safety and security for buildings ranging from large- and medium-scale to small-scale, responding to a wide spectrum of customer needs.

## Latest Technologies for and Standardization of Industrial Controllers to Achieve Smart Communities

SHIBATA Koji / ICHIKAWA Mariko / KAJIHARA Shigeru

The concept of smart communities has progressed in recent years, driven by the need to enhance energy conservation and secure stable supplies of electricity by integrating social infrastructures. In order to realize smart communities, total solutions are required for various types of social infrastructures such as electricity management systems, water supply and sewerage services, traffic systems, communication systems, and so on. Industrial controllers will make a major contribution to the development of smart communities.

Toshiba has been developing the nv series unified controllers in response to this situation. The nv series satisfy the technical requirements for industrial controllers by offering improved functionality, performance, and reliability through the application of new technologies and standardized networks.

## Technologies of Toshiba Industrial Computers and Servers Meeting Requirements of Industry

AZUMA Takao / IZAKI Kosuke / TAKAYANAGI Yoichi

With the ongoing progress of networking and layering of information in the social infrastructure field, the scale of information and communication systems has continued to expand. Industrial computers and servers for manufacturing execution systems (MESs), which connect the management and sites in the producing system, are required to provide high environmental robustness and high maintainability, as well as higher reliability compared with general-purpose computers and servers. Toshiba's latest FS5000S series industrial servers offer the advanced functions and specifications required for MESs, together with minimization of downtime due to high maintainability achieved by a design that allows parts such as power supplies, fans, and so on to be replaced from the front of the machine. High reliability is secured by the use of carefully selected parts, stringent shipment tests, and the application of our proprietary redundant array of independent (inexpensive) disk (RAID) function. Furthermore, continuity is assured by the long-term supply of the FS5000S series and compatible products for ongoing stable operation of producing systems.

## Expansion of Solutions Using Field Measurement Technologies

IJIMA Takuya / HIGUCHI Takashi / IKEGAMI Soichiro

Field devices are used in various spheres including public facilities and industry, mostly for process control systems in manufacturing lines, water supply and sewerage systems, and so on. However, the range of applications is expanding globally due to the growth taking place in developing countries and the stagnant Japanese market. In addition, a new energy control structure in smart communities has been progressing.

In response to these circumstances, Toshiba has begun offering a new solution following the approach of providing optimal functions and applications to users rather than simply supplying field devices. These solutions center around our core field devices including electromagnetic flowmeters, microwave density meters, and pressure transmitters.

## Applied Optical Technologies for Steel Rolling Lines

HAYASHI Takeshi / TAKEMURA Shota / FURUTA Tetsuo

In response to the worldwide movement toward environmental conservation as typified by the reduction of greenhouse gas emissions, Toshiba is continuously aiming at the creation of environmentally conscious products (ECPs), which are designed to embody environmental consciousness at all stages of their life cycle.

As part of this effort, we are focusing attention on reducing environmental burdens including weight reduction and power conservation in rolling measurement equipment, which plays a significant role in the steel rolling process. Furthermore, we have developed a laser thickness gauge that not only realizes highly accurate measurement with long-term stability but can also measure a wide variety of objects without limitations on their material and thickness, utilizing our proprietary applied optical technologies.

## Feature Articles

## Fault-Tolerant Quantum Computation Method Offering New Possibility

## for Realization of Quantum Computers

GOTO Hayato / ICHIMURA Kouichi

A quantum computer, which is a novel type of computer exploiting the characteristic features of quantum mechanics, is expected to achieve solutions that cannot be accomplished with conventional computers, including large-scale molecular design and the attainment of an information retrieval system with perfect privacy protection. In order to swiftly realize a quantum computer, however, a quantum error correction technology and a fault-tolerant quantum computation technology hold the key to the correction of inevitable errors peculiar to quantum computation.

Toshiba has developed a new fault-tolerant quantum computation method and evaluated it using a quantum computer currently under development. As a result, we have confirmed an error threshold for fault-tolerant quantum computation that is 10 times higher than that of conventional methods.

## SmartUJ™ Efficient and Secure Client Management System

FUJIWARA Yuji / NONOYAMA Akihiro / YAMASHITA Takumi

With the increasing number of cases of information leakage in recent years, countermeasures against information security threats have become a critical issue for enterprises. At the same time, however, demand has been increasing for reduction of management costs, promotion of teleworking as an effective means of realizing business continuity planning (BCP), and utilization of PCs in a mobile environment to improve business efficiency. The use of smartphones as a tool for improvement of business efficiency is also increasing.

Toshiba has developed the SmartUJ client management system, which expands the range of clients to smartphones powered by the Android™, and released two types of platforms: an on-premises platform that is installed in each user's office, and a cloud platform that is operated via the network. SmartUJ offers optimal services by incorporating functions for improvement of business efficiency, secure operation of mobile devices, countermeasures against information leakage, and protection of data in client PCs, as required.

## Speech Synthesis System for Call Centers with Flexibility to Handle Various Inquiries

SAKAI Shizuma / YASUDA Hirokazu

Call centers are experiencing an increasing need for automated interactive voice response (IVR) systems as an alternative to operators, in order to reduce both operating costs and the burden on operators. However, as a wide range of responses for guidance are required to handle various products and to customize the responses to each customer, the conventional method of preparing audio guidance recordings takes a great deal of time.

With these trends as a background, Toshiba has now developed a speech synthesis system for call centers that incorporates a high-quality speech synthesis engine and can function cooperatively with peripheral business systems. This system automatically generates stable response guidance texts based on information provided by customers, and responds using a synthesized voice with realism close to that of a real operator's voice.

## Compact and High-Stability Onboard Automatic Train Protection Equipment for Conventional Railway Lines

MURAI Jun / MIYAJIMA Yasuyuki / YOKOYAMA Hiroyuki / IKENAGA Shinei

To avoid malfunctions of important onboard equipment that affect the services of the train concerned and subsequent trains, commuter trains have been increasingly equipped with dual-type equipment to realize redundant systems in recent years.

In order to improve the stability of onboard automatic train stop (ATS) equipment, East Japan Railway Company ("JR East") is actively promoting the reduction of parts through integration of the transmission unit and speed collation unit as well as miniaturization, in addition to employing redundant onboard ATS equipment on its trains. JR East is also paying attention to maintainability and promoting the incorporation of onboard testing functions into onboard ATS equipment by means of a train control and management system (TCMS). For next-generation systems, the integration of various types of ATS systems, which can be used on ATS-P (ATS using pattern renewal transponder) sections in metropolitan areas and on ATS-SN (ATS using s-type transponder) sections in suburban areas, is being planned.

At the request of JR East, Toshiba has developed the "ATS-P-Ps" onboard equipment integrating the ATS-P and ATS-SN systems that can calculate ATS patterns to check the train speed using a high-speed central processing unit (CPU), and implemented the mass-production of dual-type ATS-P systems for E233 series commuter trains on the Keiyo Line.

## LDA Equipment for Tokyo International Airport

NAKAGAWA Yasujiro

A localizer-type directional aid (LDA) is an approach system for aircraft landing at an airport using an instrument landing system (ILS). LDA equipment makes it possible to provide aircraft not only with approach paths that are aligned with the runway but also with those following a curved or dogleg trajectory.

Toshiba has developed and installed dual-frequency type LDA equipment for Tokyo International Airport (Haneda Airport), marking the first time that such equipment has been installed at a Japanese airport. This dual-frequency type LDA equipment provides aircraft with a more secure approach to the airport, and is expected to meet the growth in demand for air transportation and solve various issues including the problem of aviation noise accompanying the further expansion of Haneda Airport.

## Optical Pickup System Conforming with BDXL™ Standard for Large-Capacity Blu-ray Disc™

LEE Yongjae / KIM Uiyol / KIM Youngtak

BDXL™, a standard for Blu-ray Disc™ of 100 GB or more in capacity with three or four recording layers, was established to meet the requirements for high-capacity recording.

Toshiba Samsung Storage Technology Corporation has developed a new optical system that can generate a stable servo signal and high-quality reproducing signal for BDXL™ compatible optical disc drives. By applying a polarizing hologram optical element, reflected light from non-recording layers is reduced and stable error signals against tilt and space deviation between layers are achieved. The integrated maximum likelihood sequence error estimation (i-MLSE) of the reproducing signal indicator is less than 10% of the design target, assuring noise-free playing. This optical system will be applied to optical pickups for optical disc drives for Blu-ray Disc™ of half-height (H/H), 12.7 mm, and 9.5 mm in height.

## Frontiers of Research &amp; Development

Self-Assembly Lithography Technology Controlled by Chemical Modification