

Special Reports

Measurement and Control Systems

Measurement and Control System Technologies toward 2010

OBANA Hideo

Trends in Measurement and Control System Equipment and Future Outlook

OHBA Akira / KAKEHI Atsuyuki

This year marks the 30th anniversary of Toshiba's world-pioneering introduction of the TOSDIC™ distributed digital control system in 1975. The wave of digitization has become widely disseminated in many fields since that time, encompassing power systems including nuclear and thermal power systems; industrial systems including petrochemicals, steel, foods, and pharmaceuticals; and infrastructure systems including water and sewage, road, and airport control systems. Substantial progress has been made in open system technologies, information technologies, and integration technologies, and methods of configuring control systems under total system optimization including information systems are now attracting global attention.

This paper introduces the trends and latest topics in measurement and control systems as well as their future outlook.

Industrial Controllers

--Advances in Development of High-Speed and High-Reliability Controller Technologies

ASHIDA Kazuhide

Technologies have been progressing for the standardization and realization of open architectures for programmable logic controllers (PLCs) and distributed control systems (DCS), both of which are representative industrial control equipment.

Toshiba has developed new functions and incorporated them into an engineering tool for our V-series integrated controller. These include a full CAD editor, an interlock diagnosis function, a remote engineering function, and structured text (ST) language. Moreover, taking technical trends and the social environment into consideration, we have studied hardware and software technologies to improve management and applicability to factory automation (FA) and process automation (PA) systems, and proposed the development of products to be released in the future.

New Developments for Industrial Computers

FUJII Naoki

The application of industrial computers has expanded to encompass not only factory automation (FA) systems but various other fields, including social infrastructure systems such as broadcasting and communication systems, transportation management systems, water supply and sewerage monitoring systems, electric power generation and supply systems, and building management systems; as well as automated equipment; inspection and analysis equipment, and so on. In monitoring and control systems, and equipment with embedded computers, there is an accelerating trend toward open systems and an increasing number of systems using PCs and PC servers. As a result, the requirements for industrial computers have expanded and diversified according to such factors as the purpose of use and the scale of application.

Toshiba has developed and commercialized the FS10000 series industrial computer equipped with a dual processor, and the CP10 embedded computer, in response to these diversified user needs.

Latest Field Measurement Technologies

NOZAWA Masahito / YONEMOTO Satoshi / HIGUCHI Takashi

Various types of field measurement devices such as flowmeters, pressure transmitters, thermometers, and density meters are widely applied in manufacturing process systems.

Toshiba's main products in this business sphere are electromagnetic flowmeters and microwave density meters. We have developed an upgraded electromagnetic flowmeter, the LF600 series, and microwave density meter, model LQ610, for sanitary equipment complying with food service requirements. These products are opening up new applications in the global market as they conform with the relevant standards of many countries in addition to Japan, and with the standards for digital interfaces.

Instrument and Control Products Contributing to Effective Operation of Water and Sewage Plants

MATOBA Masayoshi / SOMA Takahiro

Water and sewage systems are an important part of the social infrastructure and indispensable in people's daily lives. A water system must provide safe water at all times, while a sewage system must purify sewage and rainwater collected by sewerage pipes and transform them into clear water before discharge into a river or ocean. At the same time, reduction of electricity consumption by water and sewage plants is important to reduce greenhouse gas emissions, which lead to global warming. It is also necessary to prevent overdosing of chemicals in treated water from the standpoint of environmental preservation. In addition, the reduction of chemical consumption is important from the viewpoint of reducing the operating and maintenance costs of plants.

To meet these requirements while offering safety and security to society, Toshiba is developing and manufacturing instrument and control products that contribute to the effective operation of water and sewage plants.

Monitoring and Control of Building Automation System

IKEDA Koichi

The architecture of building automation and control systems is evolving into the Building Energy Management System (BEMS™), including energy-saving control and energy management. BEMS™ measures the status of the building facilities and space environment, performs accurate control, and stores data for reporting and analysis.

Toshiba's latest system features a newly developed micro-server that functions as a key component of BEMS™, as well as comfortable air-conditioning control incorporating a radio controller, sensors, and energy-saving control. By means of the radio controller and sensors, a specific power-saving radio system is created and an air-conditioning setup is realized that provides wireless temperature measurement of rooms. Original predicted mean vote (PMV) operation has been adopted for the system, offering comfortable air-conditioning control with an energy-saving effect.

Solutions for Measurement and Control Systems in Industrial Processing Fields

OTA Hiroshi / NAKANO Hiroshi

Thirty years have passed since digital technology was introduced in the field of measurement and control systems. Investment in plant and equipment has been rising in raw material industries such as steel and petrochemicals due to the recent growth of the Chinese economy, and this in turn has promoted the renewal of instrument systems. On the other hand, the operators who have supported the high-growth period of the Japanese economy are now aging, and it is becoming increasingly difficult to maintain safe and stable operations as well as the uniformly high quality realized by the experience and skill of these expert operators up to now. In particular, problems are expected to arise from 2007 onward with regard to the renewal of distributed control systems (DCS).

Toshiba Mitsubishi-Electric Industrial Systems Corp. has been investigating components and applications as a vendor of instrument systems in this environment and has realized ways of switching from existing to new systems with minimum time and investment. We have also developed solution packages that systematically incorporate the know-how of expert operators and engineers using information technology.

Feature Articles

Higher Luminescence LED Using Nanostructured Surface Fabricated by Self-Assembled Block Copolymer

Lithography

FUJIMOTO Akira / ASAKAWA Koji

Light-emitting diodes (LEDs) are widely used in cellular phones, display panels, traffic signals, and automobile taillights. They are also expected to be used for automobile headlamps, LCD backlights, and interior illumination. Improvement of the light-extraction efficiency is desired in order to realize LEDs with higher luminescence.

Toshiba has proposed nanostructures for antireflection and diffraction on the LED surface. A nanostructure was fabricated on a semiconductor surface by lithography using a self-assembled block copolymer as a template. The extraction efficiency increased by 2.6 times and the luminescence of the LED tip improved by 1.5 times compared with conventional LEDs.

Underwater YAG Laser Welding Technique

KANAZAWA Yasushi / TAMURA Masataka

When planning preventive maintenance of reactor components using welding, it is necessary to consider special environments such as narrow space or difficult accessibility while minimizing exposure to radiation in the reactor pressure vessel.

Toshiba has developed an underwater neodymium: yttrium-aluminum-garnet (Nd: YAG) laser welding technique. The features of this welding technique are low-heat-input welding and compact welding machine dimensions for welding in narrow spaces. This paper provides a summary of the new welding technique as a reliable welding technology.

Improvement of Write Performance of High-Density MRAM

KAI Tadashi / IKEGAWA Sumio / YODA Hiroaki / TAHARA Shuichi

It is important to develop large-capacity nonvolatile memory for successive improvements in the performance of digital devices with state-of-the-art technology. Magnetoresistive RAM (MRAM) is expected to be a universal random access memory with a combination of nonvolatility, speed, and read/write endurance. However, the mass production of MRAM requires improvement of the write property, such as enhancement of the writing region and reduction of the writing current, as well as improvement of the thermal property.

Toshiba and NEC Corp. have developed a new bit cell design that exhibits excellent astroid curves and offers the possibility of high-density MRAM with superior write performance.

Excitation System without Field Circuit Breaker

SOGABE Toshiaki / SATO Fumio / SHIBATA Masahiko

The field circuit breaker (FCB) has conventionally been used to open and close a generator field circuit. An FCB is a DC type breaker with a discharge contact. The number of FCB manufacturers throughout the world has decreased in recent years, while demand for the application of general-purpose AC circuit breakers has increased. As a result, requests for system specifications incorporating general-purpose circuit breakers have been increasing.

Toshiba has developed a new excitation system using the bypass thyristor switch system instead of discharge contact. This new system has been applied to the Enel Produzione Salsisu Power Plant in Italy. Hereafter, we will use the new system for excitation systems in general.

Frontiers of Research & Development

Application of Phased-Array Ultrasonic Test to Nuclear Internals Train Running Control Technique Using Model Predictive Control