

An innovative 2009

In ABB's labs across the world, scientists and engineers are continuously seeking ways of improving products and enabling new solutions. *ABB Review* presents a small cross-section of the company's innovation breakthroughs of 2009.

Beyond the gearbox

ABB's Direct Drive technology is delivering higher productivity and greater simplicity to the paper industry as well as winning a series of prestigious awards, the most recent being the highly respected Marcus Wallenberg Prize.

As the speed and torque of a conventional induction machine do not necessarily match those of the application to which it is connected, a gearbox performs the conversion. Induction motors are not particularly well suited for low-speed operation. Besides the

fact that their size increases with higher pole numbers, the efficiency and power factor drop with a reduction in speed. ABB's researchers realized this constraint could be overcome if permanent magnets were used because of their ability to provide a strong magnetic flux that enables higher motor torques. Using this knowledge they developed the Direct Drive solution.

This solution consists of a permanent magnet synchronous motor controlled by a low-voltage AC drive. Coupled with the synchronous Direct Torque Control (DTC), it provides better torque characteristics, precise speed control and high efficiency. The transition to Direct Drive technology reduces the



number of mechanical drive components required in many applications. These savings not only lower losses and the floor space required, but also reduce overall complexity and downtime.

For more information see "No gears required" on page 12 of this edition of *ABB Review*.

Wireless rescue

The arrival of wireless standards, such as WirelessHART™, has allowed ABB to develop an upgrade wireless adapter, which can be fitted to existing HART instruments.

It has been estimated that only 10 percent of the 30 million HART fieldbus instruments installed since 1989 have a pathway back to a host, such as a distributed control system. This means valuable information, which could be used to ensure the timely maintenance of assets in the field, is stranded. Access to this data could be achieved by adding a wire-

less network to transmit the information from each instrument back to the host system. WirelessHART™ provides a cost-effective pathway back to a host asset management system, such as the ABB Asset Vision Professional, which has built-in asset monitors for HART instruments. These are used to check instrument maintenance conditions and provide additional information to assist with fault finding.

ABB's WirelessHART upgrade adapter (NHU200-WL) can be connected anywhere within the 4 to 20 mA loop used by the instrument.

It has been developed to complement wired networks for situations where installation costs are high or when a



second maintenance network is beneficial.

For more information see "Unlocking stranded information" on page 27 of this edition of the *ABB Review*.

Integration in a refinery

ABB is providing process-control and power-management systems based on its Extended Automation System 800xA to nine of Petrobras' 12 Brazilian refineries – solutions that will help increase production by a massive 40 percent.

In many industries, power management is a vital topic in terms of costs and an important prerequisite for reliable operation. ABB's Power Management System (PMS) is based on System 800xA and uses the IEC 61850 standard for substation automation, facilitating the integration of intelligent electrical devices (IEDs). The system allows process and power automation systems to be integrated, permitting higher productivity through more far-reaching optimization of plant operations.



The introduction of IEC 61850 in 2004 was an important step forward in terms of simplifying the integration of IEDs. The standard ensures the interoperability between devices and is capable of replacing all the various protocols in the substation-automation domain.

The REPAR refinery, located in Brazil's Parana state, is one of Petrobras' most important downstream production units. As part of a larger expansion project (also involving several new

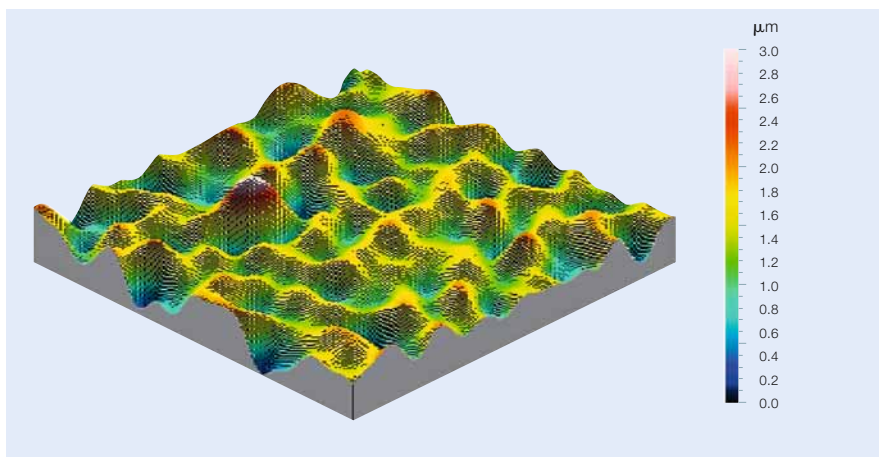
substations and increasing the energy available to the plant) ABB is currently delivering an integration solution using its System 800xA PMS that will fully integrate the process-control and power-management systems, greatly boosting plant productivity.

For more information see "Refined integration" on page 47 of this edition of *ABB Review*.

Paper run

The paper industry has long sought a caliper sensor that is accurate, reliable and does not mark or break the sheet. ABB has launched just such a sensor, enabling papermakers to continuously measure one of their most critical parameters on even the most demanding paper grades.

Caliper, or residual sheet thickness, is a need-to-have measurement for almost every papermaker. However, reliable caliper measurement has proven elusive. Traditionally, this measurement has been achieved through the use of dual-sided, contacting caliper sensors. These run small "skis" over the paper and record the thickness change with an accuracy of better than 1µm. On a microscopic level, however, some paper grades resemble the Swiss Alps and therefore pose tremendous challenges for these



contacting skis. As a result, paper sheet damage, inaccurate measurement and poor control can occur.

ABB's new optical caliper sensor overcomes these problems. Based on a confocal displacement measurement technique, this sensor significantly reduces the error from light penetration that may occur in laser triangulators (ie, the glow-ball effect). It surpasses

all other optically based caliper sensors in terms of accuracy, resolution and reliability and, last but not least, it helps papermakers reduce their energy needs, use fewer raw materials and make a better quality product.

For further information, see "Innovation in action" on page 33 of this issue of *ABB Review*.

Sunlight by cable

ABB's PVS800 central solar inverter is a reliable, economic and compact solution for connecting photovoltaic arrays to the grid. It converts the DC output of the photovoltaic panels to the AC the grid requires.

Photovoltaic energy is rapidly moving toward price parity – the point at which the price per kilowatt-hour of photovoltaic energy matches that from conventional sources. It is estimated that within five years, photovoltaic energy prices will match peak prices in areas with high isolation such as California or Italy. But already today, driven by environmental awareness, photovoltaics are experiencing rapid growth.

Features of the PVS800 inverter include reliability, longevity, fast and easy installation, a modular and expandable design and high compactness (it is the most compact design on the market). The inverter is suitable for both dedicated photovoltaic power plants and for photovoltaic systems as can be found, for example, on the roofs of commercial and industrial buildings. The PVS800 is available with power ratings from 100 to 500 kW.



Power can be fed directly into the distribution grid or, using a transformer and switchgear, into the medium-voltage grid.

For more information see "From light to power" on page 22 of this edition of *ABB Review*.

Slim switchgear for wind turbines

Traditional wind-turbine switchgear is not known for being slender, and certainly is not capable of fitting through a tower door. Rather, it is installed either inside the tower base or in a small secondary substation built alongside the tower.

In the former scenario, the equipment must first be placed on the base before the tower is fitted over the equipment. Replacing the switchgear inside has – until now – been a challenge.

As part of its SafeWind portfolio, ABB has introduced a slim, compact and flexible 36 kV circuit-breaker panel for wind applications that enables simplified installation and replacement. Only 420 mm wide, the entire breaker can easily fit through the tower door of a wind turbine during installation. This circuit-breaker panel, SafeRing 36, is a part of the SF₆-insulated ring main unit product range for 36 kV secondary distribution networks.

SafeRing 36 will be discussed more fully in an upcoming edition of *ABB Review*.



A crystal clear solution

It is estimated that 2 percent of all electricity generated is lost due to distribution transformer inefficiency. An inventive approach to improving this number and achieving a lower total cost of ownership is the use of amorphous metal.

Amorphous metal is a unique alloy whose structure of metal atoms occurs in a random pattern. It is this structure that makes it possible to minimize no-load losses in transformers. Traditionally, cold-rolled grain-oriented (CRGO) silicon steel, which has an organized crystalline structure, has been used to manufacture transformers. However, the higher resistance to magnetization and demagnetization because of the crystalline structure leads to higher core losses. Thus, as part of ABB's commitment to increasing efficiency and to sustainability, the company developed an amorphous core distribution transformer for dry and oil-filled types.



losses and add it to the cost of a transformer. Therefore, it is more economical for a utility to invest in a low-loss amorphous core transformer even though the material weight of an amorphous core is slightly higher than for conventional technologies. In the future this will be a significant driver for energy savings and reduced greenhouse gas emissions.

This new transformer reduces no-load losses by 60 to 70 percent. The no-load loss of a transformer is particularly important because most of the time distribution transformers are operated well below their nominal load. Increasingly, utility companies consider the no-load losses when they evaluate different transformer technologies. They attribute a value to the

losses and add it to the cost of a transformer. Therefore, it is more economical for a utility to invest in a low-loss amorphous core transformer even though the material weight of an amorphous core is slightly higher than for conventional technologies. In the future this will be a significant driver for energy savings and reduced greenhouse gas emissions.

Subsea transformer

ABB has been developing subsea transformer technology for almost 25 years. Such specialist transformers are used to power pumps and compressors and other electrical equipment deep beneath the sea's surface to keep oil and gas wells productive for longer.

ABB has been developing subsea transformers that can operate at depth, under pressure, since 1985. These developments have enabled the oil and gas industry to exploit deep-water oil fields 50 km or 100 km offshore. These transformers are rugged and reliable. They are housed in a special high-grade steel casing able to cope with the high pressure

and corrosive action of deep sea saltwater. Their components are extremely robust since repairs cannot be made easily, due to their relative inaccessibility during operation.

To avoid pressure problems at depth, all air- and gas-filled vaults within the outer casing are eliminated by immersing components in a high-class insulating oil with a low expansion coefficient to cope with elevated operation temperatures. Rigorous tests carried out on all components have ensured that all 15 subsea transformers currently installed are operating reliably and safely. ABB remains the world's only manufacturer of subsea transformers capable of delivering reliable power underwater with minimal losses.



For more information, see "Under pressure" on page 25 of this edition of the ABB Review.

Navigating by four colors and intuition

The name “Living Space” stands for a new generation of building-system technology from Busch-Jaeger, a member of the ABB Group. The innovative interface concept is applied in the company’s Busch-priOn® control panel, incorporating the philosophy that while technical systems grow ever more sophisticated, they should remain intuitive and simple to operate.

The KNX-bus-based control systems allow comfort functions such as light, heating, blind settings and also home entertainment systems to be controlled from a single panel using a single interface philosophy. The system furthermore allows the definition of complete scenarios of settings appropriate to a given situation.

Busch-priOn was developed in a customer-focused process with special emphasis on ergonomics and ease of use. The objective was to make elementary functions such as “lights on” as simple as flicking a switch while passing by. More complex functions should not be significantly more difficult to access.

The control panel is based on a 3.5-inch TFT display and a knob that can be both rotated and pressed, much like those found in cars or on mp3 players. The background color of the display changes to reflect its present functional mode: yellow for lights, blue for blinds, orange for heating and air conditioning and magenta for scenarios – a system that can be understood internationally and independently of language.

Busch-priOn is rounded off by elegance of design and technical perfection.

Busch-priOn will be discussed more fully in an upcoming edition of *ABB Review*.



A complete range to Relion®

ABB’s Relion® portfolio is the first protection relay product family that covers the complete application range, from basic distribution to high-end transmission applications – globally – and conforms to the native IEC 61850 standard.

The Relion product family now covers the widest range of products for the protection, control, measurement and supervision of power systems for any transmission and distribution application, thus ensuring security and reliability regardless of the operating environment. For the first time in the industry, the IEC 61850 standard for modeling of data and applications has been incorporated into an entire product family.



This unique feature enables ease of use and a more efficient experience for customers.

The comprehensive Relion portfolio offers both ready-to-use solutions and customization possibilities for specific applications. It is a common tool for application and communication configuration as well as disturbance handling, ensuring engineering efficiency. Relion is backed by ABB technology, global application knowledge and experienced technical support

throughout the life cycle of the products. Two new families within the Relion portfolio are the 615 series for distribution applications and the 670 series for transmission.

Within arm's reach

The IRB 120 robot is the smallest addition to the ABB family of single-armed robots. It is ideally suited to a wide range of tasks, including the handling and assembly of small, delicate components of up to 3 kg in weight.

The IRB 120 offers all the functionality of other ABB robots but in a much smaller package. It has a single articulated arm designed to mimic the reach of a human arm. Its numerous mounting options mean it can be arranged to minimize its footprint within a production line. Its slim wrist and internally routed cables allow it to be used in tight locations, and the easy-to-clean surfaces make it ideally suited to applications requiring dust-free environments.

The robot is light, weighing in at just 25 kg, and features the best path accuracy and motion control on the



market. Smooth movement and accuracy are achieved using ABB's new lightweight (27.5 kg) IRC 5 Compact controller, the latest addition to ABB's comprehensive IRC 5 family of robot controllers. The combined weight of the IRB 120, its IRC 5 Compact controller, floor cables and FlexPendant is less than 60 kg, providing a truly compact, lightweight robotic system.

ABB has many years of experience in the automation business and is partic-



ularly well equipped to automate production processes. The new compact IRB 120 robot and IRC 5 Compact controller will together extend ABB's automation solutions to industries concerned with the assembly and handling of small, complex components and devices.

For more information see "Dexterous and articulate" on page 39 of this edition of the *ABB Review*.

Extended reach and swift action: the new IRB 2600 robot

With the launch of its new IRB 2600, ABB is setting a new benchmark in terms of speed, accuracy, compactness, mounting flexibility and protection for a robot of the 6 to 20 kg payload range.

The new IRB 2600 permits a range of mounting variants ranging from floor to shelf, wall and even inverse mounting. This huge flexibility, combined with the robot's compactness, helps make the robot at home in applications where space is at a premium.

Another strength of the new robot is its large working range. For the larg-



est of the three subvariants, this extends to 1,174 mm below the robot's base plate (ideal for shelf-mounted applications serving injection molding machines) and 1,853 mm forward of its main axis.

The IRB 2600 is also at the forefront of providing protection options. Ranging from hostile foundry environments, where it must withstand high temperatures or even droplets of molten metal, to ultraclean environments where it must avoid contaminating photovoltaic-cell assembly lines or bread packaging lines, the IRB 2600 can fulfill a broad range of protection requirements. All variants feature IP67 ingress protection, which means they must survive submersion in up to 1 m of water, and be totally resistant to dust ingress.

For more information on the IRB 2600, see "The extended-reach robot" on page 42 of this edition of *ABB Review*.