

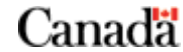
Synergy Award for Innovation

Natural Sciences and Engineering Research Council of Canada
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Rockwell and Ryerson “motoring” their way to success

If a Canadian household can save \$20 a month in electricity costs by using more energy-efficient devices, imagine how much large industries could save by doing the same.

A long-standing collaboration between Rockwell Automation Canada Inc. and Ryerson University is helping out. They have made numerous technological advances in power electronics and electric motor drives — the backbone of modern industry — that promise to help companies in Canada and around the world cut energy consumption and boost productivity in a big way. And that, of course, means big savings.



Bin Wu
Ryerson
University



Steve Rizzo
Rockwell
Automation
Canada Inc.

A driving force in industry

Electric motors, large and small, are integral to such areas as manufacturing, transportation, and automated process control. The “command centre” of the motor is the electric drive, which controls the torque, speed and position of one or more electric motors. Electric drives are used widely in industry to conserve energy, increase productivity and improve product quality. However, they also consume approximately 50 per cent of the electricity generated in Canada.



The Conference Board of Canada
Insights You Can Count On

In recent years, improved technology and fierce competition have lowered the selling price of drives while increasing their performance. This is a good thing for industry, and the environment. But it also means that drive manufacturers must work that much harder to stay ahead in the game.

As one of the world's leading manufacturers of high-power motor drives, Rockwell is well aware of this.

The A(B)Cs of motor drives

Rockwell pioneered the current standard in electric drive technology in the early 1990s with high-power, medium-voltage AC electric drives. In 1994, Rockwell began the first of three (so far) NSERC Collaborative Research and Development (CRD) projects with Dr. Bin Wu, a professor in the Department of Electrical and Computer Engineering at Ryerson. Since then, they have been developing new motor drive technology with greater marketing potential by reducing the physical size of the product, increasing its reliability and lowering its manufacturing costs.

“Each CRD project has been an innovation within itself,” says Steve Rizzo, Manager of Medium Voltage Research and Development at Rockwell, “but the first project led to the formulation of the second, and the second to the third. In our third CRD project, we’re looking at up-and-coming, super high-power motor drives, with a view to extending our product range.”

These super drives are used in extremely large projects, such as in the oil, gas and mining industries, where only three or four contracts are awarded each year. They’re quite lucrative — up to \$10 million per year — because they’re so specialized. And because the current technology used in industry is 10 to 20 years old, there’s a real push to implement the latest cost-cutting advancements.

A patented success

Wu and his research team are currently working on two other projects with Rockwell. Together, they have developed a number of innovative techniques for controlling large-horsepower medium-voltage drives, co-authored more than 30 technical papers and filed five patents.

“We have an excellent relationship with Dr. Wu and his students,” explains Rizzo. “They record their research precisely, so we don’t have to spend time unbundling algorithms to understand the work. Our team of engineers regularly exchanges technical information with them, and both parties benefit from new ideas and approaches.”

Likewise, Wu appreciates what Ryerson gets out of the collaboration. “Both undergraduate and graduate students acquire first hand industrial experience, which is difficult to obtain in the classroom, and they apply theory to real-world situations. Also, the university researchers keep in close contact with industry, which helps them define current and future research directions.”

“Almost all the students and post-doctoral fellows trained through the collaboration have found jobs in Canadian industry,” Dr. Wu says proudly.

“It’s purely a matter of capacity that Rockwell doesn’t hire all the students coming out of this system,” adds Rizzo. “We’d love to hire more.”

Academic and commercial success

Over the past eight years, Rockwell and NSERC have made a total cash contribution of \$870,000 and in-kind contributions of \$443,000 to Dr. Wu’s laboratory. And to get the most of the support, Dr. Wu is making sure the majority of the research money goes to training highly qualified personnel and buying equipment.

Rockwell was also the major industrial partner in support of Ryerson establishing a state-of-the-art Laboratory for Electric Drive Applications and Research (LEDAR), which is a motor drive research facility at a low power level. LEDAR complements the test facility for high-power medium-voltage levels available at Rockwell. Having both of these facilities available to the collaborative project helps ensure its success.

Ahead of their time

Some of the successes of the Rockwell Automation–Ryerson University partnership are way ahead of their time. One example is a novel active-damping control scheme that would give the electric drives the ability to power multiple motors. However, this development is currently “on the shelf,” waiting for semiconductor and heat-transfer technology at medium voltage to catch up with devices having lower watts loss and thermal resistance.

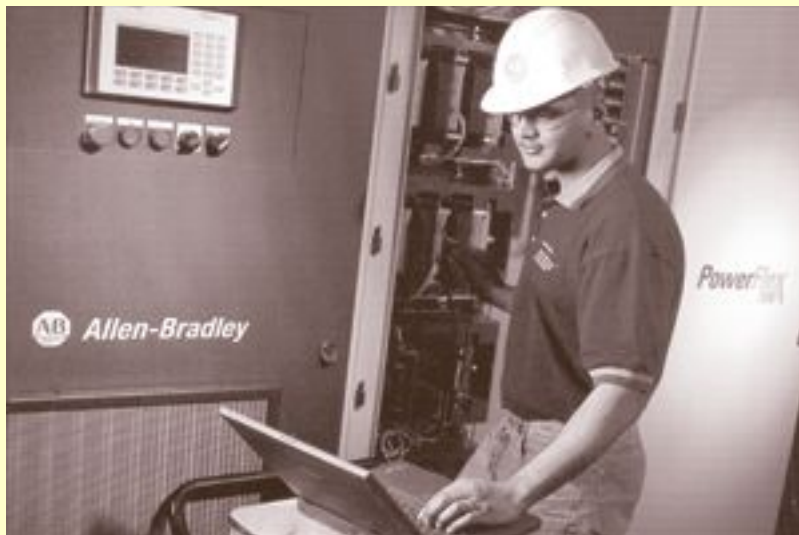
“We must accept that sometimes other factors delay implementation,” says Rizzo. “We’re building a portfolio of technology that will be extremely useful down the road.”

One of their most significant achievements is a new methodology for common mode voltage mitigation, which reduces the voltage stress that drives impose on motors. Because the patent is pending, details are shrouded in secrecy, but Rizzo is very

excited. "This is a unique innovation and a unique implementation," he says. "It's more practical and usable than anything that has previously been patented. Once we integrate the technology into our products, it will give us a considerable competitive edge through continued size reduction and simplifying the application of medium-voltage high-power drives.



Demonstrating a novel technique for power semi-conductor placement in the manufacturing process.



Verifying a start-up algorithm in a Rockwell medium-voltage drive.

