Driven world

Drives, motors and controls are bread and butter stuff, aren't they? Brian Tinham examines what's new, what's changing and how all that might affect plant engineers

Unless you're heavily involved in project work, chances are your experience of drives, motors and controls is wide – after all, it's bread and butter stuff – but not as wide as it could be. So a quick update would be useful. Especially if it turned out that you could be saving time and money, and/or improving plant controls.

Can't promise the earth, but did you know, for example, that there's another change on the way for electric motor efficiency classification? The industry is about to drop EN 60034-2 in favour of EN 60034-2-1, which gives more accurate results and ties up with American standards. In addition, the old voluntary efficiency markings Eff1, Eff2 and Eff3 are to be phased out and replaced by IE codes from EN 60034-30. So what? Well, first, by 2010, the numbers change – from Eff1 being the highest, to IE1 the lowest (Eff2 today); IE3 will be today's premium efficiency and IE4 the future highest class.

What's more, because of the Energy-Using Products Directive 2005/32/EC, we'll be under pressure to use high-efficiency motors, whether they're justified or not. As Geoff Brown, application consultant with drives giant ABB, puts it: "Even if you're installing fire pumps that will only run on test for an hour a month, the European Commission will force you to use efficient motors at a cost premium of, say, 20%." Not smart, but that's how it's looking.

Next, what about intelligent variable speed drives? Practically all the manufacturers now say there's spare drive computing power, not needed for auto-tuning or drive management, and they're making that available for controls and diagnostics.

Phil Larkin, technical director of Hitachi specialist Silverteam, says plant engineers need to check this out. "One of our customers wanted an overload warning signal, but didn't want it to kick in on start-up. So they bought a timer from RS to provide a delay – even though that's built into most inverters. They could have saved themselves the cost of the timer, as well as the installation and testing."

ABB's Brown adds: "We've built smart pump control into some of our drives. By monitoring motor torque and speed, they can calculate flow and efficiency without an expensive flowmeter. That means we can do clever things, such as detect pump impeller fouling or solids deposition in the pipework [with a pressure transducer] and then automatically initiate de-ragging or pump scour."

Anglian Water is a current ABB user, while Northumbrian Water has seen success with a similar approach on Control Techniques' (part of Emerson) drives – with automatic cleaning cycles being triggered by rising torque current. Costs in each case were fairly marginal against cost of the drive.

Spare smart power

Meanwhile, others talk of crane and winch controls, with automated sequences and dual motor controls – switching between long and cross-travel motors – all programmed into the drive. And although that has been around for a while, it's now far easier to set up, using standard PLC programming tools.

Even fairly complex synchronisation controls on, for example, industrial conveyors or rollers in paper and steel mills, can be handled by intelligent drives. Control Techniques implemented rolling mill controls for Istil in Sheerness, which makes reinforcing bar on a 20-rolling stand production line. CT general manager Dave Baston explains that its drives were configured to synchronise speed of the rolling stands, with communication cascading from stand

Pointers

- Efficiency standards and classifications are changing: IE1 will be today's Eff2, IE3 will be premium efficiency and IE4 the new top level
- Before buying auxiliary kit, check out your drive: many have a host of extra features
- Drive intelligence is being used for everything from pump control to tolling plant synchronisation
- Permanent magnet motors and ac machines are well worth reviewing
- Harmonics and power factor must not be ignored
- Cheap equipment does not always mean better

to stand to ensure tensionless rolling. "That yielded a 30% increase in production and a 15% improvement in quality," he says.

Back on motor efficiency, there's a discernible trend away from gearboxes, with their attendant losses – particularly worm gears – towards direct-drive permanent magnet motors. Why? Because they're energy efficient and you can now get much smaller, cheaper devices, with reliable base speeds of 120rpm, instead of the more usual 1,500rpm.

But it's not just about slow speed. Andy Green, who looks after large drives for CT, suggests using permanent magnet motors for many applications. "Given that running costs are more than 95% of a motor's whole life cost, shaving 1% off that can make a significant difference to whole life cost."

Move over to ac

What about ac versus dc? There's no let-up in the demand for dc motors, despite their higher maintenance – partly because they're still cheaper than ac, and partly because design life is mostly long enough for maintenance not to be troublesome on small motors. However, on larger motors, that's less the case and the threshold for ac is falling. So, unless you're saddled with spares or there are skills issues, it's worth changing to ac at rebuild time.

Moving on to safety, Rockwell drives engineer Dave Withenshaw suggests that relays, interlocks and guards will soon seem passé. "We already have zone safety and our drives feature a Safe Off facility, which inhibits the transistor firing pulses, ensuring no torque at the motor. Going forward, we'll see safety futher integrated, allowing zoning, so that, if a safety zone is infringed, it may not be necessary to shut down the whole machine – just that area."

What about fieldbus – the digital plant monitoring and control networks replacing 4—20mA controls? Standards have been around for more than 15 years, yet advocates still speak with a zeal that smacks of novelty. Nevertheless, many drives have long since been sold with fieldbus cards – much the same as pressure transmitters in the process instrumentation sector.

Most commentators report gradually increasing usage – indeed Rockwell's Withenshaw reckons that 60—70% of his customers are now using fieldbus (DeviceNet, Profibus or Ethernet IP). "We're seeing more customers using our toolset to set up fieldbus drives communication. It's so easy: you can put a drive on the network with a couple of mouse clicks. Then, once it's active, there's also full web server capability, so that users can access what's happening on that drive, wherever they are."

Before closing, a brief word on three remaining issues: harmonics, power factor and quality. First, Silverteam's Larkin emphasises how little it takes for harmonics to cause problems. He suggests filters as standard remedies, but warns that we can't rely on voltmeters to check they've cracked it.

As for power factor problems – caused by inductive loads generating circulating currents – Adrian Larmour of Deritend suggests solutions include: minimising idling and lightly loaded motors; avoiding operation of equipment above its rated voltage; installing capacitors (although never with inverter-fed motors) to reduce reactive power; and using high-efficiency motors.

And finally, quality: motor life depends on shaft vibration, how frequently the machine is started and a range of environmental factors. It also depends on quality of the bearings, the casting, insulation, even the inverters used. Currently, the market is flooded with Chinese motors that are as cheap as chips, but how can you check what's under the covers? You pays your money and you takes your choice. PE

Smart drives curb coiling

When pneumatic positioning systems couldn't provide the accuracy for steel company Corus Colors, systems integrator Boulting Technology turned to ABB's high-performance drives. The drives' intelligence and interfaces enabled the firm to deliver a compact, accurate and low-cost solution.

The 0.75kW drives are used on four positioning systems for the coiling operation at Corus' Shotton Works on Deeside. A major customer wanted steel coils wound on cardboard tubes, so Corus developed an automated loading system for the cardboard inners, in which the tubes slide onto a saddle-shaped arm, which swings round to align with the mandrel, ready for winding.

Which was fine, except for the swinging motion of the arm. "The problem was that the rotating system has a non-linear load," explains Nick Bennett, senior project electrical engineer at Corus. "The load exhibits stiction, so additional torque is required to start the arm moving. The new drive control continuously adjusts the torque and speed to achieve the required motion profile – difficult to achieve with an air cylinder, because you can only make adjustments between operations."

His observations: "We are now able to program the drives to fit each operation exactly, in terms of speed, acceleration, deceleration and end of motion. One of the main benefits is their reliability. We don't have to keep adjusting them, whereas we continually had to adjust the pneumatic systems. The drives have also solved a health and safety issue by reducing manual handling."