SOFTWARE

On-Machine Inspection Drives Quality

Ed Vella is president of Marposs Corp. (Auburn Hills, MI), a developer of metrology equipment and solutions.

Manufacturing Engineering: How critical has on-machine inspection become for today's manufacturers?

Ed Vella: The truth is that it's extremely critical, but not all manufacturers have recognized that fact—yet. Staying competitive today means having your process under control from the first part. If something goes wrong, you need to know it as soon as it happens, not minutes or hours later. The only practical way to do that is to migrate the critical primary inspection operations upstream from the QC lab to the production floor, and that's what on-machine inspection lets you do. With today's technology you can accurately measure most key dimensions and geometric features right on the machine using the same sensors and probes employed for tool setting, presence detection, and other standard processes. These technologies don't replace the CMM in the QC lab, but they do give you an almost instant 'heads-up' to the kinds of process deviations that result in lost production and scrap parts—things like thermal changes or tool wear that need to be compensated for as soon as they happen.

ME: Are there other advantages to be gained from on-machine inspection?

PASSWORD

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Ed Vella

Vella: Absolutely. On-machine inspection not only means checking the part, but also checking machine performance that affects part quality and machine productivity. My company supplies various systems to help accomplish this, including balancers for tool vibration, acoustical sensors for tool integrity, and power-monitoring sensors. So, on-machine inspection enables a greater probability of producing only good parts, and to be able to react immediately if something goes wrong.

ME: What are some barriers to on-machine inspection, and how widely used is it by industry today?

Vella: On-machine measurement and inspection is becoming more widely used and, in some cases, is insisted on by the machine builders who are expected to deliver process-capable machines, cells, and systems. However, some manufacturers reject on-machine inspection because of their perceptions of lost throughput on the machine, a lack of available space in the machine for measurement equipment, or the idea that gaging is a 'non-value-adding' operation.

The fact is that these are not legitimate barriers in most cases. Cycle time does increase due to on-machine inspection routines. However, the cost of increased cycle time must be compared to the incurred costs of machine downtime while waiting for off-line part measurement and the scrap parts produced before an off-line gage indicates that the process is out of control. On-machine inspection can dramatically reduce the time it takes

to detect a process that is out of control and enable automatic correction of process influences. It can also eliminate operator influence over the process and, in many cases, help to reduce labor costs.

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ME: What are some new software tools available for on-machine inspection, and how can these help manufacturers?

Vella: The new tools are getting much of the attention, and rightly so, but I don't want to lose sight of the fact that much of what we're doing today is based on an expanded role for technologies that have been performing on the shop floor for 50 years. On-machine inspection is a perfect example of finding better ways to use what we already have. Our new 3D Shape Inspector software has the power to turn a CNC machine tool into a practical, shop-floor CMM, within the constraints of the performance limitations of the actual machine. That means the same machine that makes the part can now inspect it using the existing probing system and an external PC. Using it, operators can immediately recognize out-of-specification parts and apply the necessary corrections. But that's only the most obvious benefit. The software uses DMIS code to generate a part measurement program, just like a CMM. When that code is input into a CMM, it will touch the exact same points inspected by the software on the CNC machine, closing the inspection loop and validating the on-machine measurements. By doing that periodically, it's possible to free up the CMM to handle other tasks, and possibly eliminate the need for an additional CMM. The software is also able to study factors like clamping force and thermal variance deformations on the part. The obvious advantage here is that the part is inspected before it has a chance to either relax or cool, which can't be done on a CMM. So the software is a perfect adjunct to the technologies that are already being used on the shop floor.

ME: How can software tools help manufacturers be more efficient with measurement tasks?

Vella: Software products like 3D Shape Inspector can significantly expand the capabilities of existing gaging hardware. But, here again, the products already on the shop floor can be used in new and different ways, and much of that is software-driven as well.

We have found that the most effective way to implement on-machine inspection is to couple it with process-monitoring software that identifies trends in the machine performance and part quality. These programs can alert operators, maintenance personnel, and plant managers to upcoming problems before they happen. It's pretty clear that the future of manufacturing will be more automated, more intensely monitored, and more self-regulating than anything we've seen to date. All of that progress will be software-based in one way or another.

ME: What are some other technical challenges facing manufacturers in obtaining quality parts through effective measurement programs?

Vella: If the future is software-dependent, and I think it is, then the biggest challenge manufacturers will face is the challenge of effectively integrating all of the computer-based technologies into a functioning, interactive system. On-machine inspection will generate the data required to regulate the production process, but using the data effectively is still a major challenge. The first step may well be as simple as training an operator to enter the correct offsets based on the measurement information, but that's not the long-term answer. Eventually, the machine tool, the on-machine inspection system, and the QC lab processes will all have to be seamlessly integrated into a single, self-monitoring and self-correcting system. That's a challenge that will keep us all busy for quite a while.

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ME: What's the overall outlook for the manufacturing industry in 2007?

Vella: It's going to be more competitive, more global, and more technology-driven. The winners will be those companies that embrace change and master the technologies that let them reduce costs while improving quality. This takes vision and investment that will ultimately translate to improved profitability and quality for the manufacturer. Labor costs are only part of the equation, and simply relocating production to low-labor-cost markets isn't the answer. There's a lot of focus on that right now, but I'm convinced the winners in the global competitive shakeout will be the manufacturers who make the best and most innovative use of technology to advance their productivity and quality. It's things like on-machine inspection and closed-loop quality systems that will make the difference in the long run, not cheap labor.■