# IR Monitor Tracks Weld Defects in Auto Plant

Air-bag canisters, transmission components and other steel parts require precise, durable welds to ensure safety. As an alternative to arc welding, automakers are increasingly turning to $CO_2$ and Nd:YAG laser welding, which, in many cases, offers higher process speeds and increased precision. But as laser technology catches on, so does the need for reliable methods for ensuring the integrity of each weld.

Engineers at DaimlerChrysler faced that challenge at the Indiana transmission plant in Kokomo, which manufactures transmissions for the Jeep Grand Cherokee. Ultrasound monitoring systems equipped with large dunk tanks were used to evaluate welded gear-train components at the plant. Although sensitive and effective, ultrasound had its drawbacks. These systems required a high degree of sophistication to set up and maintain. Inspection was dependent on parts design, material velocity and probe type. And the systems carried hefty price tags — about $50,000 apiece.

The engineers wanted a simpler and less expensive solution, so they adopted an infrared laser weld monitor available from Spawr Industries Inc. in Lake Havasu City, Ariz. Originally designed at Argonne National Laboratory in Illinois, the monitor uses a passive sensor and optics that are integrated into the laser beam delivery system. The IR detector collects emissions from directly above the weld and supplies information about the heat generated by the laser in real time. Integration of the detector into the beam delivery optics makes the system compact and less susceptible to misalignment.

"The Spawr weld monitor was chosen to eventually replace the ultrasound systems because of its simple setup and installation requirements," said Jack Evanecky, an engineer at the transmission plant. "The ultrasound systems required a high level of maintenance to ensure a valid test, and were very susceptible to false rejects due to slight inconsistencies in either the part presentation or material."

Once the plant adopted the IR weld monitors, destructive tests — once performed hourly — were no longer needed. Scrap decreased 10 percent and, because monitoring occurs in real time, processing speeds were faster.

"Spawr's weld process monitor helped to control our process variations by establishing a laser processing tolerance band," Evanecky said. "Variations caused by increased feed rates, improper shield gas and beam position were all easily identified." □

*Michael D. Wheeler*

*Contact: Walter J. Spawr, Spawr Industries Inc., Lake Havasu City, Ariz.; (520) 453-8800. Jack Evanecky, DaimlerChrysler, Kokomo, Ind.; (765) 854-4231.*

# Software Adds a New Dimension to Robot Vision

Machine vision's two-dimensional perspective is increasingly adept at locating, identifying and qualifying parts moving through a production process despite variables in how those parts are oriented or illuminated. However, two dimensions cannot contain the expanding reach of applications performed by robotic systems that must operate in three-dimensional space. One solution, "robot vision," was developed by Fanuc Robotics North America Inc. The robotic vision software package, visLOC, is based on Cognex Corp.'s PatMax software.

"Machine vision is very good at identifying and locating a part. We need to understand where the part is in relation to the robot, which is robot vision," explained Ed Roney, a senior product manager for Fanuc Robotics. "We need to understand how to calibrate the image to the robot, or use multiple cameras to look at a very large part like a car body and then adjust this space to allow the robot to move around the part."

## Another dimension

Unlike many machine vision systems that simply qualify items in their environment, robotic systems must manipulate or interact with these items. This requires real-time image processing software that can recognize partially covered parts oriented between 0 and 360°, regardless of variations in background or illumination. PatMax can negotiate this in less than 60 ms. "It provides robust algorithms in 2-D image space," Roney said. "We add the calibration and understanding of the images to the robot workspace."

Cognex's software also helps to make machine and robotic vision more accessible to the untrained user, according to Roney, who pointed out that a standardized and routine implementation of vision systems is made difficult because systems are usually customized to fit individual applications. This lack of standardization requires more intensive interaction with the customer, he said. Otherwise, the technology can become misapplied and eventually abandoned.

"PatMax is more user-friendly, but it can also handle more variations than normalized correlation software," he said. Fanuc Robotics' visLOC vision package was introduced in July. □

*Daniel C. McCarthy*

*Contact: Cognex Corp., Natick, Mass.; (800) 677-2646. Ed Roney, Fanuc Robotics North America Inc., Rochester Hills, Mich.; (800) 477-6268.*