Controlling the force

A major German automotive aluminum supplier is gaining numerous benefits from using ABB's Force Control package.

Text and photo: ABB Robotics

The adaptive motion controller adjusts the behavior of the IRB 6660 in response to the forces it encounters.

Because of its low weight in relation to its strength, aluminum is one of the most important materials in the automotive industry. The MWS Group supplies almost all major manufacturers and specializes in the production of highly complex, ready-to-install aluminum castings. At Garching, near Munich, the company uses sand casting to manufacture items such as engine mounts, differential housings and oil pans. These components are then cut and milled by a type IRB 6660 ABB industrial robot in a production cell manufactured by Automations Robotic GmbH. In this process, a worker clamps the raw parts in a workpiece positioner that carries the parts into the robot cell for processing. Once the robotic processing is complete, the part is transferred to the next work station.

The IRB 6660 is the most rigid of the articulated ABB robots. Its robust design makes it ideally suited to MWS's needs. "Processing the aluminum parts involves high process forces and generates a great deal of grime and chips," says Steffen Klan, who heads the work preparation and project management department at MWS Garching GmbH. "We need a robot that functions flawlessly under these difficult conditions. Since we primarily manufacture components in small or medium-sized batches, we found it important to choose a robot system that could be rapidly retooled for different components."

The Omega 190 force and torque sensor, located between the robot's wrist and the power tool, is part of the Integrated Force Control function package, which enables real-time adaptive motion control. "Where conventional robot solutions are controlled using predefined paths and speeds, Force Control allows the robot to react to its environment and modify its programmed path or its preset speed on the basis of feedback from the force sensor," explains Uwe Seip, sales engineer at ABB Robotics.

The Force Control technology gives the robot the ability to autonomously and situationally adapt its behavior to the process forces it encounters. MWS uses the SpeedChange function, whereby the programmed path and force remain unchanged while resistors govern alterations in the speed so as to precisely generate the contour of the prescribed shape.

By reducing the robot's speed in the presence of high forces, Force Control reduces the risk of damaged or improperly machined parts and is gentle on the tools. This extends their service life.

"Processing parts with the Force Control technology not only has a positive impact on the durability of the tools, but also to the life cycle of the spindle and the accuracy of the robot axes. In addition, we were able to reduce the cycle times by 20 percent with this technology," Klan says.

Another advantage of Force Control is its intuity. "The operator moves the robot by hand to the positions where processing is to take place," Seip explains. "In a second step, the robot automatically and adaptively learns the positions it will actually need along the contour of the component. A menu-driven graphical user interface guides the user through the normally complex programming process with just a few clicks."

Klan summarizes the collaboration very positively. "ABB didn't just supply the individual elements of the Force Control package and help with the commissioning process, it also supported our search for possible improvements," he says.

For example, to increase the IRB 6660 robot's rigidity and precision for the specific application, MWS decided to set it up at an angle. ABB then carried out a series of tests at its technical center in Friedberg to determine the ideal angle. The result was 5 degrees – and that is exactly the angle at which the robot now processes aluminum parts at MWS Group.

Scan the QR code (right) to see ABB Robotics Integrated Force Control.