SIEMENS

ArvinMeritor

Using process simulation to handle increased product complexity

Product

Tecnomatix

Business challenges

Exhaust system complexity increases demands on production planners

Quality standards and tight deadlines leave no room for mistakes

Keys to success

Employ Tecnomatix to simulate manufacturing cells and all production steps – from insertion of components to welding and extraction of completed components, including arc welding

Significantly reduce manufacturing rework prior to production

Continue to meet or exceed rigorous quality standards

Results

Ramp-up time has been shortened considerably

Rework prior to start of production decreased by more than 50 percent

Major process errors have been eliminated

Quality standards met/exceeded

Tecnomatix production simulation capabilities help meet the demands of manufacturing today's complex light vehicle exhaust systems

Building in quality from the start

Today's vehicle exhaust systems must meet high fuel efficiency and environmental standards. In order to guarantee the quality of the complex exhaust system components from the beginning of the production process, many factors have to be considered in production planning and fixture design. Process simulation is an important tool for detecting and eliminating early-stage problems. ArvinMeritor is using Tecnomatix® Robcad™ simulation software in its Augsburg-based manufacturing resource building department to meet these demanding standards.

Worldwide component supplier ArvinMeritor produces mainly exhaust systems for high-end passenger vehicles like the Porsche Cayenne, the Volkswagen Touareg, the Mercedes SL and the BMW X5
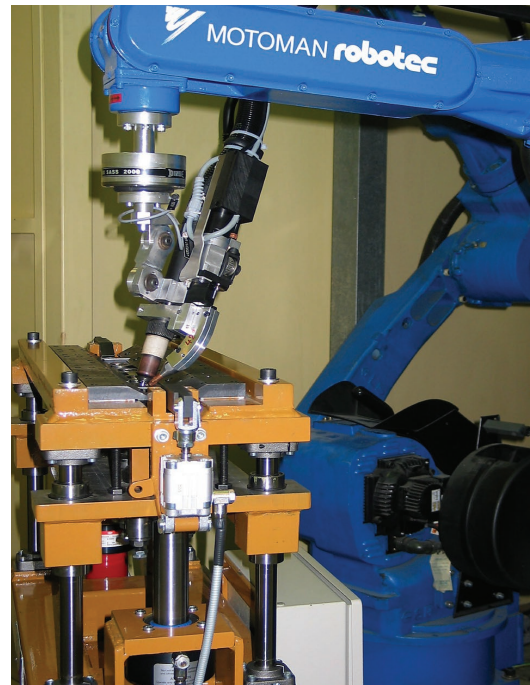
The robot in position to weld the inbound flange to the manifold component group.

as well as models by Audi, Volvo, Fiat-GM, Lancia and Alfa Romeo. Air gap isolated manifolds are supplied to BMW for its six-valve diesel engines in its 3, 5 and 7 series.

Augsburg serves not only as the production location, but also the R&D and test center. With innovations like the diesel particle filter for light vehicles and changes in "Active Noise" and "Thermal Management" – as well as with new eco-friendly materials (storing mats for ceramic catalysts) – ArvinMeritor is armed for the future.

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"Ramp-up time has been shortened considerably due to (Tecnomatix) simulation."

Dr. Michael Krannich
Manager, Manufacturing Resource Development
ArvinMeritor

High-productivity industrial facilities, production lines

High-grade stainless steels are used for exhaust system production, guaranteeing an exhaust system life span of approximately 160,000 kilometers. Components with highly complex geometries for manifolds and catalysts are automatically produced with the help of welding robots. Because of an air gap to optimize thermal characteristics, these components have mostly isolated external and internal bodies that will be assembled as one unit over several steps.

Six-axis welding robots made by Motoman Robotec are used in the manufacturing cells – in addition to devices that accomplish both robotic and rotational motion for positioning components along additional axes, allowing up to seven or eight axes. This permits the production of many components in one process step, despite the complexity of the welding lines.

Both welding processes – metal-active gas (MAG) and wolfram-inert gas (WIG) – are used. The latter procedure, which helps eliminate contaminations of the surface and therefore impairments to the exhaust system and damages to turbochargers and catalysts, will be used for welding internal components. The workstations are prepared according to requirements with a robot equipped with MAG or WIG welding device, or both types of robots are used in one manufacturing cell at the same time. The synchronized welding will again raise the requirements for process development and fixture design in order to control the cooperation of two robots with the device.

Manufacturing resource building

There are 50 people employed in ArvinMeritor's manufacturing resource building department in Augsburg. The department is involved in production planning and process development, and is responsible for the design and production of manufacturing

The external jackets of the manifold will be welded into this device.

resources and partially carries out the setting-up operation for the devices. Besides welding and mounting fixtures – including control, measurement and testing systems – other special machines and complex robot cells are developed and produced as well. Their customers are not only the production department in Augsburg, other plants of ArvinMeritor worldwide but also external companies from the automotive industry.

The department, the size of a small business, is equipped with several machining centers, including Deckel-Maho, Hermle and Soraluce, as well as machines for turning, milling, grinding and eroding. A coordinate measuring machine guarantees the adherence to construction defaults. While incidental work can be carried out with the department's own machinery, simple work will be outsourced to external suppliers. Design will be done with Catia V5 and manufacturing with a complete CAD/CAM/ CAQ chain.

In recent years products have become more complex and the appliances and manufacturing processes therefore more and more time and cost consuming. The manufacturing resource building department is using the simulation program Tecnomatix Robcad to reduce the time it

takes to begin production of the manufacturing resources and also to avoid failures, which could require time and cost-intensive rectifications. Thus, potential problems can be identified in the very beginning and can be accounted for in the construction of the devices. Manufacturing cells and every production step from insertion of the components to the welding and extraction of completed components can be simulated with the Tecnomatix solution.

Process simulation includes arc welding
For approximately five years ArvinMeritor has been using Tecnomatix Robcad for its manufacturing resource production. Dr. Michael Krannich, manager of manufacturing resource development, decided to use the simulation software and its arc-welding module. Based on a detailed specification sheet, which required among other things the simulation of arc welding with six-axis robots and two external axes, the installed software, running on a PC, is equipped with a library of all current robots and is expandable, letting

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Solutions/Services

Tecnomatix
www.siemens.com/tecnomatix

Customer's primary business

ArvinMeritor is a global component supplier headquartered in Troy, Michigan with operations in 25 countries; the company employs around 31,000 people.
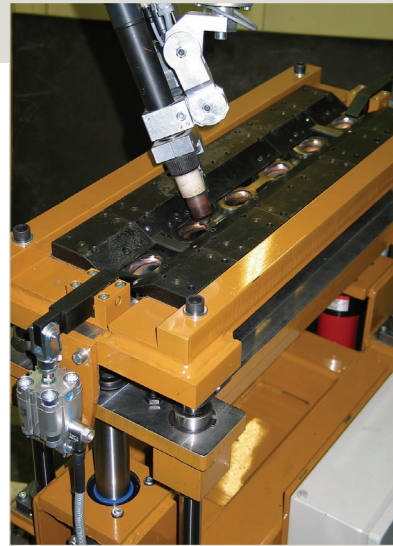www.meritor.com

Customer location

Augsburg
Germany

ArvinMeritor add models and functions, thanks to its open architecture. This made it possible for Tecnomatix to expand the robot simulation by the seventh and eighth axes, necessary for positioning the welding devices at ArvinMeritor.

In cooperation with Siemens, the software was enhanced at ArvinMeritor to allow the simulation to completely display the production processes. A trainee program for the designers was run in parallel.

All the engineering data from the produced workpieces and devices are imported into workcell layouts modeled in the Tecnomatix software. The responsible simulation engineer then takes into consideration shop floor data and the movement of workpieces from one manufacturing cell to another. Through the software-generated collision list it is possible to clearly estimate whether and where problems might occur – whether during the insertion of components in the devices, the extraction of welded assembly groups or directly during welding.

The solution puts in place a close feedback loop between the design engineers conducting the process simulation and the manufacturing engineers building the components. This happens at an early phase of production, which can take up to 20 weeks for complex devices. This teamwork optimizes the production process by enabling the modification of components and devices based on simulation results. Almost every complex welding device will be simulated to take advantage of any early error detection. It is possible to program the robots offline, enabling an accuracy of less than one millimeter in test runs.

Moreover, without the simulation software from Tecnomatix, ArvinMeritor's manufacturing resource building department would not be able to implement these complex manufacturing processes. "The ramp-up time has been shortened considerably due to simulation," says Dr. Krannich. "Manufacturing resources can be provided trouble-free, and the necessary reworks made prior to start of production decreased by more than 50 percent. Major errors do not even occur anymore. This is absolutely necessary, as today's typical deadlines and quality standards in the automotive industry don't allow for second chances."