Automotive Engineering: Rapid, Flexible, Economic

Optimized production by means of by programmable casting system

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Short set-up times, optimized operating sequences, high productivity, process stability and quality are the demands made on nearly every company today. The German foundry Georg Fischer meets them by the use of industrial robots and highly efficient automation technology. A multitude of these tasks is handed over to external specialists.

Despite the existence of platform strategy, serial production, component families and standardisation in the automotive engineering sector, many components still require the production of several versions which must be produced economically and delivered just-in-time. The Georg Fischer GmbH in Garching near Munich, part of the GF Automotive Group, is also facing this problem. Specialised in the production of sand castings made of aluminium the foundry’s business activities include the computer-aided design, development and complete processing of pre-finished castings made of different aluminium alloys.

In the past the liquid metal flowed from the holding furnace via pouring channels into the moulds. This resulted in relatively long set-up times when changing over to other moulds. And only experienced foundrymen were able to adjust the channels and the required melt correctly. In addition it was necessary that operators checked the pouring process and cleaned the pouring channel repeatedly during casting. Malfunctions and maintenance works at the pouring channel reduce the efficiency, productivity and flexibility of the castings. Furthermore, the operator-related function of the pouring channel may affect the quality of the castings.

Operations of the moulding and casting line FA1 have become considerably more flexible and economic since the new casting system FlexCast has been introduced.
into the Garching foundry. Developed by the automation specialists of Robotec Engineering GmbH in Bad Säckingen, this system consists of an industrial robot which pours the required melt into the moulds. Depending on the capacity, the pouring ladle holds up to 100 kg of liquid metal and can be changed rapidly by means of a quick-clamping-system.

The pouring axis protects all temperature-sensitive components, such as the servo motor for driving the ladle, from the hot melt. Furthermore it allows for the exact movement of the ladle to take up the liquid metal from the holding furnace and pour it into the mould. The motion sequence is performed by means of two con-rods and eccentric shafts, virtually independently of the temperature and free from float. This design allows for exact movements, high positioning and dosing accuracy, achieving tolerances of less than one percent.

The con-rod gear is extremely rigid and free of maintenance and wear for a long time. It is permanently lubricated and protected with a steel case against ambience conditions, thus granting reliable operation even under unfavourable environmental influences.

The use of industrial robots for the pouring process has many advantages. First of all it allows for high flexibility. The motions of the robot are programmed and controlled by means of software specifically developed by the automation specialists of Robotec Engineering GmbH. The company with a staff of 30 is specialized in the design and development of handling and automation technology for foundries.

The software allows for the parameterization of the casting sequences without programming skills. The parameters for the movements of the industrial robot, the so-called casting curve, are simply entered on a touch screen. These include the positions to go to, the immersion depth of the ladle into the melt, the slew rate and the angle position of the ladle during mould filling. When the parameters have been entered, the controller saves the data in a data base, so that they can be retrieved and re-used on demand or automatically. This reduces the set-up time for the casting robot to a minimum and allows for high flexibility during the pouring process.
The casting robot is additionally connected with a second industrial robot which drills gates and feeders into the sand mould. As both robots use data from the same database, the set-up times for the mould and casting lines are reduced. When changing over to another casting type, the casting robot automatically takes over the positions of the gates, thus preventing any transmission errors. This results in a high process stability, even if the positions of the gates and feeders change.

Via a network the data are stored in the central database and in the controller of the casting robot. It automatically corrects the positions for the pouring of the melt, thus granting that all plant components required for the casting process operate with the current data set. This avoids scrap castings and equipment downtime. With the introduction of the new casting system, the Garching foundry has considerably improved their flexibility as well as process stability and quality during the casting process.