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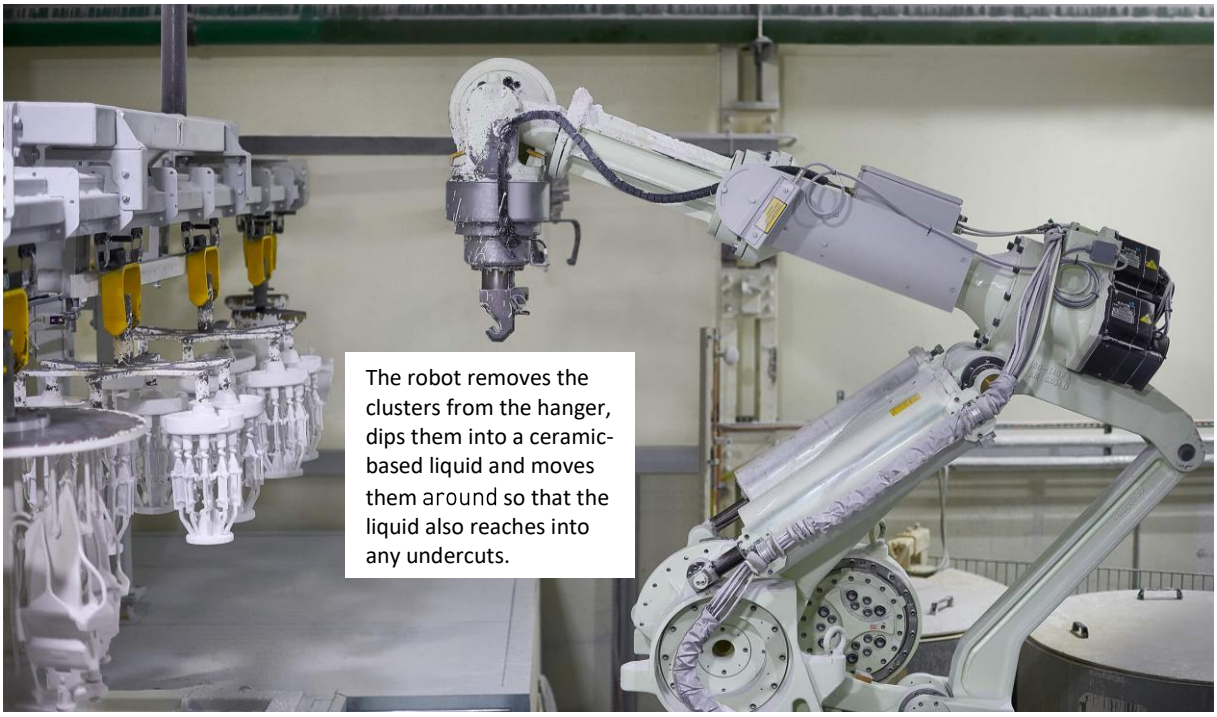

The robot removes the clusters from the hanger, dips them into a ceramic-based liquid and moves them around so that the liquid also reaches into any undercuts.

Field communication

Wireless sensor detects positions of clusters

Wireless connection to a robot gripper – the industrial engineers at Doncasters in Bochum have single-handedly realised this type of signal transmission. The wireless sensor signals the operational status of the gripper.

At Doncasters Precision Castings (DPC) in Bochum, precision moulding results in blades and vanes for stationary gas turbine power plants and aircraft engines. The factory, which has more than 500 employees, relies on an extensive vertical range of manufacture and produces its own moulds. A robot dips a wax cluster into a basin containing a ceramic-based liquid and moves it around so that the liquid also reaches into any undercuts. The robot then holds the cluster in a rotating drum, where it is covered in sand. The result is a ceramic casting mould around the wax model. In a subsequent process, the wax is melted out of the casting mould, and the mould shell filled with hot liquid metal in a vacuum furnace at

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temperatures of up to 1,500 °C. The final stage is a controlled and very slow cooling process.

The technicians faced a challenge regarding handling of the clusters prior to dipping them into the moulding liquid. Maintenance expert Guido Neef: "The cluster is removed from its rack hanging from a suspension track by the robot gripper. A bolt drives pneumatically into the core of the hanger to fix the swinging cluster. That is a prerequisite for accurate three-dimensional movement of the cluster into the basin."

QUOTE

"We will successively equip all robots in our mould production with wireless sensors."

Guido Neef, Doncasters Precision Castings

Optimisation was required here because, in some cases, the bolt of the robot gripper could not drive into the hanger – namely if the bolt was tilted or otherwise not perfectly positioned. The machine then fails to detect that the cluster guided by the robot is able to swing. This entails the risk of a collision with machine components.

Guido Neef's idea: a sensor which detects whether or not the bolt has been driven into the hanger. In principle, monitoring like this is easy to realise, for example using an inductive sensor. In this case, however, the challenge was the power and signal cables: "Because the gripper has to be able to rotate 360°, a cabled power supply is difficult to realise. This is also why the bolt is driven pneumatically." The logical solution: a battery-powered sensor which sends its "bolt fully extended" signal remotely, enabling cables to be eliminated all the way to the end of the gripper head.

Reliable signal transmission

Intensive searching for a suitable sensor led Neef to the website of steute business division "Controltec", which offers a comprehensive range of industry-compatible wireless switches and sensors. These devices are supplied with power by a longlife battery and communicate via radio with a corresponding receiver unit, which in larger machines is located inside the control cabinet.

Following advice from steute, a cylindrical wireless RF IS M12 inductive sensor was selected. A separate compact module manages both the power supply via battery and the signal transmission. It uses sWave wireless technology, which was developed by steute and guarantees reliable signal transmission even in adverse industrial conditions.

The maintenance team at Doncasters initially installed one such sensor on a robot gripper for test purposes – protecting the separate battery module with an enclosure they had built themselves. The sensor is fixed inside the gripper and detects reliably whether the bolt is fully extended and the (otherwise swinging) link between gripper and cluster rigid. It then transmits a signal remotely to a receiver unit with antenna, fixed to the control cabinet a few metres away.

Damage ruled out

The outcome of retrofitting the robot head with a wireless sensor speaks for itself: the wireless sensor with point-to-point

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wireless connection functions perfectly, even within threshold ranges. The robot does not start until the bolt is completely driven into the gripper. This eliminates any risk of loss or damage to the machine, as well as to the casting moulds. The consequence for Guido Neef: "We will successively equip all robots in our mould production with wireless sensors."

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