

Strong Technology for Steel Wheels

In its production of rail wheels, the Russian company OAO EVRAZ Nizhny Tagil Metallurgical Plant benefits from two newly implemented lines for transportation and final inspection. Thanks to the modern solutions from the Tomsk Electronic Company, it was possible to significantly increase production capacity and improve the quality of the wheels.



SME Tomsk Electronic Company
uses Cartesian manipulators to
transport railway wheels

Rail transport of goods is increasing every year. As a result, the demand for providing high-quality rail transportations is also increasing, which increases the load and requires more transportation facilities and rail components of high quality. In this connection the quality and reliability of railway wheels are especially important and can only be guaranteed subject to modern technical equipment being available. The Russian company Scientific and Manufacturing Enterprise Tomsk Electronic Company (SME TEC) has necessary experience in developing integrated solutions for rolling. SME TEC has, for example, implemented a number of projects on railway wheel production, particularly final inspection and heat treatment lines.

High-quality production and reliable acceptance thanks to modern solution

The developments of portal systems based on Siemens software and hardware tools at SME TEC started in 2005 when two robotic facilities on the basis of portal manipulators were designed and supplied within the framework of reconstruction of the railway wheel inspection line at OAO Nizhny Tagil Metallurgical Plant (OAO NTMK). The main purpose of robotic facility was railway wheel inspection automation. The facility of more than 100 m in length included 4 portal manipulators, car conveyor, 4 stations with NDT equipment (dimensional measurement, internal and visual defects, hardness testing), shot blasting machine for wheel web and equipment for preparation and application of railway wheel paint coating. In the middle of 2007 the first facility was brought into operation, and at the end of 2007 the works on the second line were finished and the equipment was put into operation in full.

The second phase in development of this direction was a delivery of another robotic facility for railway wheel hardening station. The Simotion motion control system was used as a main control system for transportation equipment and portal manipulators. These works started in November 2007. Under contract with the German company Andritz MAERZ GmbH SME TEC began to develop transportation equipment and manipulators for a railway wheels and tyres heat treatment line. Within the framework of this project eight robots have been manufactured, among which were advanced equivalents of previously manufactured single-handed manipulators and giant manipulators being able to handle four wheels simultaneously. By the end of 2008 the first stage of the process line was successfully put into operation.

Expanding the geography of deliveries to the international level was an important step in development of this direction for SME TEC, which took place after signing the contract for delivery of robotic transportation facility for railway wheel production for high-speed locomotives for the Chinese company Maanshan Iron & Steel Co. Ltd. The core of this facility was a 24 m long double-handed portal manipulator. During implementation of the project SME TEC provided designing, development of design documentation, manufacturing and supply of the robotic transportation facility and successfully brought it into operation by the end of 2012.

At the beginning of 2012, according to the upgrade plan for railway wheel final inspection lines of OAO EVRAZ NTMK, SME TEC jointly with NPO INTROTEST began to develop and install equipment ensuring 100% magnetic particle inspection of railway wheels at the existing lines.

Independent control of the manipulators

The triaxial Cartesian manipulators are used for gripping, lifting, and lowering, as well as for horizontal transportation of correctly manufactured wheels.

They have a special mechanism for gripping and are equipped with five axes with servodrives for the most accurate operation possible. The current solution is based on modern servomotors with reducing gears, namely the Simotics S-1FK7 servomotors. Using these it was possible to significantly reduce both the weight and the dimensions of the drive. The servomotors also make forced ventilation unnecessary and improve the accuracy of the positioning of all axes through the use of encoders with a high resolution. In addition, all motors with reducing gears have encoders with Drive-Cliq interfaces. By using the DME20 Drive-Cliq hub modules, it was possible to reduce the length complexity of the cabling and the costs of installation and control system parameterization.

However, the full potential of the drives can only be exploited through the use of the modular Sinamics S120 servodrive in combination with the Simotion D425 motion control system. With Sinamics and Simotion, all the manipulators can be controlled independently of each other. This is important, as they must handle numerous tasks, such as position control and steady speed control. Precise control of the manipulator movements is also important because the operating areas of manipulators cross over the operating areas of adjacent devices and units that can result in emergency situations. The use of Siemens solutions allowed to simplify development of the emergency shutdown system (ESS) through the built-in functions of motion control of the axes and data exchange between the motion controllers.

By no means unimportant is the fact that the selected solutions provide the line changeover from one standard size of output products to another in automatic mode.

Impressive results

Thanks to the use of modern, integrated solutions, SME TEC has managed to develop and implement solutions ensuring the fault-free production and inspection of up to 350 000 railway wheels per year in automatic mode.

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