

CASE STUDIES



Integration of four laser technologies

Solution brings a unique integration of four laser technologies into one automated development

First installation of a multifunctional cell in the European scientific sphere

For the first time in Europe, a comprehensively prepared multifunctional cell has been installed for scientific purposes. It was developed and launched for the needs of CTU and the Czech Institute of Informatics, Robotics, and Cybernetics (CIIRK). The launch allowed the institutes to join an elite group of European laser development centres operating similar workstations. Its uniqueness lies mainly in the number of laser applications located within a single cell, which can also be automatically and repeatedly changed during the process and thus processed by various technologies within a single production cycle.

Methodological settings under the supervision of LASCAM specialists

The entire cell is controlled by a parent Siemens SINUMERIK control system that controls the robot and additional axes. Peripherals such as the laser, extraction, wire feed, and triggering of the protective atmosphere gas are controlled by the PLC. Checking safety compliance is another important function of the PLC. The statuses of the emergency buttons and the closure of all cell entrances are checked to prevent laser radiation from escaping the work area. The working process itself is then controlled by an NC programme. The programme includes blocks determining the movement of the robot and blocks controlling the peripherals. Peripherals are controlled by M and H auxiliary functions. The Siemens NX environment has been used for off-line programming on a virtual workplace model (digital twin), including generating the NC code. The methodology of all these parameters and their time sequence in this project were handled by LASCAM specialists.







Internal equipment of the cell

The entire system is designed as a 9-axis system. Inside, the cell is equipped with a 6-axis robot, a linear slider, and a rotary folding table operating in two axes. Eight of the these nine axes can be synchronised, i.e. their reconfiguration can be done simultaneously and automatically.

Additionally, inside are installed four different laser process heads, which are linked to one laser radiation source with a maximum power of 6 kW and a wavelength of 1,070 nm. Process head replacement is fully automatic and can also be performed during processes.

3D laser cutting

Laser cutting is provided by the SolidCutter laser process head from Precitec, which can be operated up to 4 kW. The system is equipped with its own capacitive control, monitoring the distance from the material using its own Z axis. The workpiece is positioned using a rotary folding table with a load capacity of up to 500 kg. This makes it possible to move the part dynamically and synchronously during the process.

Powder welding

YC52 process optics from Precitec have been installed in the cell for powder welding. This is complemented by a fully automated powder feeder with heated jars, to avoid the process being affected by humidity. The installed technology allows the mixing of various powder materials to create different ratios of welded materials. In addition, if the powder is not mixed until during welding, the ratio in which the powders are mixed can be changed, and thus more durable properties of the resulting materials on the parts of the product that are more stressed can be exploited. The laser passes through the centre of the nozzle and a mixture of inert gas and powder is fed to the laser focal point. The inert gas serves not only to protect the welded material from oxidation, but also as a powder carrier. At the focal point, the powder is melted and welded onto the base material.

Laser welding using WOBBLE technology

The installed IPG Wobble Head D50 laser process head allows various oscillation shapes at frequencies up to 700 Hz (linear, ring, figure-of-eight or other user-generated shapes), which provides a significantly wider range of possibilities and results in high weld quality, especially when the welded materials do not completely fit (allowing optimisation of the bath for welding). The system is supplemented by an additional wire feeder with back control for the material feed stability.

3D printing with additional wire

The welding process is performed by the CoaxPrinter welding head from Precitec. This head allows the wire to be fed coaxially with the laser, which in turn allows welding in all directions. The laser exits the ring-shaped aperture and thus energy is supplied evenly into the process. To prevent oxidation, argon is fed into the process as a protective atmosphere.

Use in industry

> Thanks to this multifunctional cell, academic institutions have obtained a unique workspace for the testing (e.g. testing various types of powders) and development of laser processes and methodologies, which can then be implemented very quickly into existing conventional laser processes. It is especially applicable in the engineering, aerospace or automotive industries. It can be used, for example, for custom production, repairs of already worn parts, coatings to extend the service life of existing parts, or for the production of whole new parts.