LASER SYSTEM TECHNOLOGY
MACHINE TOOLS WITH INTEGRATED LASER SYSTEMS

The integration of laser systems into conventional machine tools makes it possible to carry out turning, milling and drilling processes in combination with new laser processes such as laser hardening, laser alloying, laser structuring and laser cladding without the need to reclamp the workpiece.

Benefits of laser integration

• Extended functionality of machine tools
• Higher production flexibility and vertical range of manufacture
• Reduced lead times for the production of complex components

Our services

• Development of modular laser machining heads that can be fitted into the conventional tool holders of machine tools
• Development, implementation and qualification of solutions for laser integration into existing production systems
• Development of self-adjusting laser beam guidance systems
• Development, implementation and certification of special-purpose machines for integrated laser machining
• Laser integration into progressive dies for laser-assisted shearing and forming

Our skills

• Outstanding expertise in both the fields of production machines and laser system technology for the development and implementation of laser integration solutions for industrial use
• Conception, design, implementation and qualification as well as certification of laser integration solutions into existing production systems and machine tools
• Many years of experience in the development and implementation of laser machining heads for individual tasks involving laser material processing and laser-assisted machining
• Comprehensive expertise in the development and implementation of special-purpose machines for hybrid laser-assisted machining processes
DEVELOPMENT OF ACTIVE LASER BEAM GUIDANCE SYSTEMS

CO₂ laser welding and cutting systems use copper deflection mirrors to guide laser radiation from the laser source to the tool center point. The maintenance of these “flying optics” includes the disassembly, cleaning, re-assembly and adjustment of the deflection mirrors. The manual maintenance currently required limits the availability of these production systems. Fraunhofer IPT has therefore developed active laser deflection mirrors with both integrated camera monitoring and automated beam guidance adjustment functionalities.

Benefits of active mirror modules with integrated sensor technology

- Fast automated mirror adjustment enhances the availability of production systems
- The combination of large optical travel range with high resolutions replaces time-consuming manual preliminary adjustment as well as fine adjustment of the mirror modules
- The deflection mirror surface can be monitored for an increase in contamination during laser operation

Our skills

- Extensive experience in the design and system integration of piezoelectric actuating units
- Specialized knowledge in the design of flexures and hydrostatic travel transmissions
- Outstanding control design expertise for the implementation of machine-integrated automated adjustment of laser deflection mirrors

Our services

- Development, implementation and qualification of laser reflector modules with integrated actuator and sensor technology
- Development and implementation of self-diagnosing laser beam guidance systems
- Development of control technology for the automated adjustment of active laser reflector modules
Laser-assisted hybrid processing combines laser-induced material softening with conventional processes such as chipping, forming or chipless shearing. Laser-assisted turning and milling enables for the first time the geometrically defined machining of brittle-rigid high-performance ceramics. Laser-assisted compression forming locally augments the degree of deformation in the forming zone of the workpiece significantly. Laser-assisted punching (shearing) enables conventional punching machines to produce punched separation planes with 100% flush-cut surfaces, and also significantly reduces cutting forces, material warping and noise emissions.

**Benefits of laser-induced material softening**

- Localized laser-induced material softening reduces cutting and forming forces while simultaneously improving processing quality
- Localized laser-induced heating of the material in the shearing zone prevents component warping
- Using laser radiation as heat source enables rapid adjustment of the laser power depending on varying process requirements

**Our services**

- Development, implementation and certification of special-purpose machines for laser-assisted machining
- Laser integration into existing machine tools for laser-assisted machining
- Individual process development and process studies on laser-assisted machining

**Our skills**

- Competencies unrivaled anywhere in the world in the development of laser-assisted sheet metal working and process integration into conventional punching machines and progressive dies
- For the first time it is possible to integrate galvanometer scanner systems into punching presses e.g. progressive dies for the serial production of sheet metal parts, using our in-house developed hybrid damping system
- Extensive expertise in the development of laser integration solutions for the industrial use of laser-assisted machining
- Combined process and system expertise for developing and designing laser-assisted machining processes
- Many years of experience, which help us to avoid negative interactions between the sensitive laser system components and the rough production environment of machine tools