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MULTIFUNCTIONAL LASER ROBOT CELL WITH DIGITAL TWIN

Task

Multifunctional laser technology integrates different laser processes in a manufacturing cell to meet the increasing demand for agile production technology. For this purpose, Fraunhofer ILT is developing a processing head that – for the first time – masters cutting, joining and deposition welding in one robot cell without it needing to be retooled. By developing a digital twin of the overall system in parallel, the institute aims to accelerate and optimize the robotic cell engineering up to its virtual commissioning.

Method

The multifunctional laser head makes it possible to flexibly set the optical parameters for the different processes. It also provides appropriate gas supply via an autonomous nozzle and feeds consumables via an integrated wire nozzle. Setting up the digital twin required a steep learning curve, which was mastered in co-operation with the project partners and supported by the system suppliers Siemens and ABB: This included modeling the 3D mechanics in NX-MCD, behavioral model in SIMIT, PLC programming in TIA Portal, virtual control with PLCSIM Advanced, and virtual robot controller with Robotstudio.

Results

The approach described here has led to a first multifunctional laser robot cell and its digital twin. Virtual commissioning has not only facilitated the design, but also optimized the mechanics, control as well as the programming of the entire system. Communication between the control system and the components takes place in a practical combination of PROFINET and hard-wired I/Os.

Applications

With this development, Fraunhofer ILT and its partners have constructed a multifunctional laser robot cell based on a digital twin for the first time. Thanks to the virtualization model, the entire system can be commissioned more quickly, the susceptibility to errors in production preparation reduced significantly, and production planned more efficiently. Applications can be found wherever the industry requires high variant diversity, fast product changes, and systems that can be easily reconfigured. The development aims at applications for producing electric vehicles and opens up many more beyond that.

Contact

Dipl.-Ing. Martin Dahmen, Ext: -307
martin.dahmen@ilt.fraunhofer.de

Dr. Dirk Petring, Ext: -210
dirk.petring@ilt.fraunhofer.de

1 The real and virtual process
   running in parallel.
2 Virtual robot cell in the digital twin.