



INLINE SENSOR SYSTEM »BD-X« WITH FPGA ELECTRONICS FOR REAL-TIME DATA PROCESSING

Task

Absolute measuring interferometric sensors are used in production measurement technology for the non-contact detection of geometric features. The sensors developed at Fraunhofer ILT have measuring ranges of up to 20 mm, achieve measuring accuracies of 1 µm and operate at measuring frequencies of up to 80 kHz. The continuously generated data volume of 300 MB/s must be processed in the measuring cycle, and the data processing must be carried out without interruption and in real time to control production processes.

Method

Field programmable gate arrays (FPGA) are particularly suitable for continuously processing large amounts of data since they allow parallelization and, thus, acceleration of computationally intensive operations. Fraunhofer ILT has developed an interface board based on an Arria 10 module from Intel with its own programming and put it into operation for the first time as part of the INSPIRE R&D project funded by the Federal Ministry of Education and Research BMBF.

1 Optoelectronic DIA converter for fiber-optic transmitted control signals with connected optical waveguide (blue).

2 »bd-4« sensor and FIRE data processing electronics with fiber optic measuring arm (yellow).

Results

The institute has determined the response delay time between an external signal triggering a measurement and the output of a control signal calculated from the measurement result experimentally: It is 0.1 ms. At the FPGA the control signal could be transmitted as an optical, pulse-coded signal with an effective resolution of 16 bits over a distance of 100 m and then as output via a DA converter. The optical transmission is advantageous because it is insensitive to electromagnetic interference in an industrial environment.

Applications

First applications are the autofocusing of laser machining processes and the control of cold rolling processes in metal processing. Fraunhofer ILT has developed »bd 1« and »bd 4« sensors with one or four independent measuring arms for these and other applications, such as laser welding or laser cladding. Available measuring wavelengths are in the ranges around 835 nm, 1 µm and 1.5 µm.

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