STRAIGHTNESS INSPECTION OF Profiled MATERIALS

Initial Situation and Motivation
Profiled materials, such as U, I, square or round profiled bars are used as base material to manufacture many products. These semi-finished products are normally drawn and rolled or extruded. Different applications have increased requirements for the straightness of base materials, which is the prerequisite for the end product's functionality.

The Measurement Technology
Profiled materials are inspected in two steps. First, relevant regions of the profile surface are digitized three-dimensionally. In a second step, the data is evaluated, the geometric parameters are determined and a classification of good or bad is made.

The Measuring Principle
OptoInspect 3D technology inspects the quality of a product’s geometry directly in the manufacturing process. Optical contactless measurement systems based on this and adapted to specific tasks inspect the straightness of profiled bar stock directly in the manufacturing line. Automatic measurement and data evaluation facilitate the fastest delivery of inspection results possible and thus immediate process feedback.
yaw, are detected and compensated as a function of the position measuring system’s configuration.

**Measured Data Evaluation**
Available as camera images, the sequence of profile sections along the profile axis generated by scanning a structural element constitutes the basis of measured data evaluation. In a first step, 3-D data is computed once the evaluated measured data has been preprocessed. The position of each laser line in the camera image is determined and parameters from the calibration of light-sectioning sensors are used to compute 3-D data for every profile section. A sequence of precise cross sections along the profile is produced by projecting the data onto a plane perpendicular to the profile axis. Subsequently, a feature point with a fixed reference to the profile axis is computed for every cross section. Mathematical approximation fits reference geometric elements (straight lines, circle segments, curves) in proper areas of the profile cross sections and, from this, one feature point is determined for every profile cross section. This produces a sequence of feature points that represent the profile in space and thus its straightness like string of pearls.

**Determination of Straightness**
Depending on the shape of the profile, the chain of feature points is analyzed either symmetrically or axisymmetrically. The chain is examined in different projection planes, e.g. in the horizontal and vertical planes. For the different planes, mean, inner or outer reference straight lines are fit into the straightness profile according to defined rules compliant with the standard DIN ISO/TS 12780-1, Geometrical product specifications (GPS) – Straightness. This serves as the basis for determining straightness parameters.

**Advantages and Benefits**
OptoInspect 3D measuring technology automatically inspects the straightness of profiled materials directly in manufacturing. The sensor unit’s flexible configurability permits customized measurement uncertainties and a wide diversity of different profile forms. The technology is suitable for all materials that are opaque and do not have any reflective surfaces. A multitude of already implemented system solutions has demonstrated the technology’s suitability for industry.

For more information on this topic, visit www.mpt.iff.fraunhofer.de.