

Geometry-Controlled Free-Form Bending Process

A Miniature Free-Form Bending Machine with Post-Bending Kinematics for Process Control

Motivation

The free-form bending machine is able to bend tubes and profiles of different radii without changing tools. The biggest advantage of free-form bending with movable tools is the seamless connection of different radii in one component. Particularly suitable areas of application for this machine are those with workpieces of different sizes with large radii.



Illustration 1: 6-axis free-form bending machine.

The main objective of the proposed research project is the development of a smaller free-form bending system with downstream bending kinematics and an in-line measuring system for influencing the workpiece geometry.

Approach

The present proposal is characterized by an innovative idea, which consists in the development of a model-based mini free-form bending machine with downstream bending kinematics. For this purpose, the component geometry must be measured in real time and during bending. The values determined in this way

are then compared with the target values. Deviations that occur can be compensated for by a so-called post-bending kinematics. The aim of this two-stage forming process is to increase process stability and optimize geometry matching. In order to master these tasks, cooperation between two applicants from the fields of control engineering and production engineering is required. The primary goal is to research and perfect the interaction between bending machine, measuring technology and post-bending kinematics within the framework of a 2D bending process. Based on the knowledge gained, these methods will then be transferred to 3D bending and the large free-form bending machine.

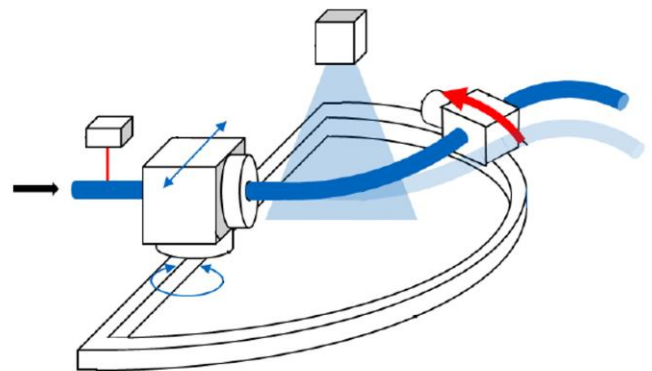


Illustration 2: Schematic representation of the bending concept.

Inference

The measurement, use and control of local component properties through the massive use of measurement and materials technology, control systems and process engineering leads to a paradigm shift in the design of the free-form bending process.