Freeform bending

Methodology for the design of freeform bending tools for square profiles

Motivation
The freeform bending technology offers a lot of potential for the development of complex bending parts. Therefore, tubes as well as open or closed profiles can be used. Currently, common inefficient trial-and-error procedures with numerous iterations are used for designing and manufacturing freeform bending parts.

This elaborate and expensive procedure is to be replaced by defined methodologies based on exact knowledge of the process and the materials. This allows the manufacturability to be evaluated as early as the development stage, which saves time, money and resources.

Approach
First, the cause-effect chains are investigated. Therefore, process parameters and tools are researched regarding their interactions. Simulation models, a test bench and a freeform bending machine by J. Neu GmbH provide the possibilities to do so at the utg. Figure 1 shows the bending machine at the utg.

Figure 2 shows the simulation model for the freeform bending of a rectangular shaped tube using LS DYNA.

Summary
The developed methodology is based on the knowledge about the process, the cause-effect chains and the material behaviour. It consists of three parts as shown in Fig. 3. First, a part is designed as a digital model. Second, a tool analyses the part regarding manufacturability and a feedback is given. Third, the specifications for the setup of the machine and the development of the suitable set of tools are given.