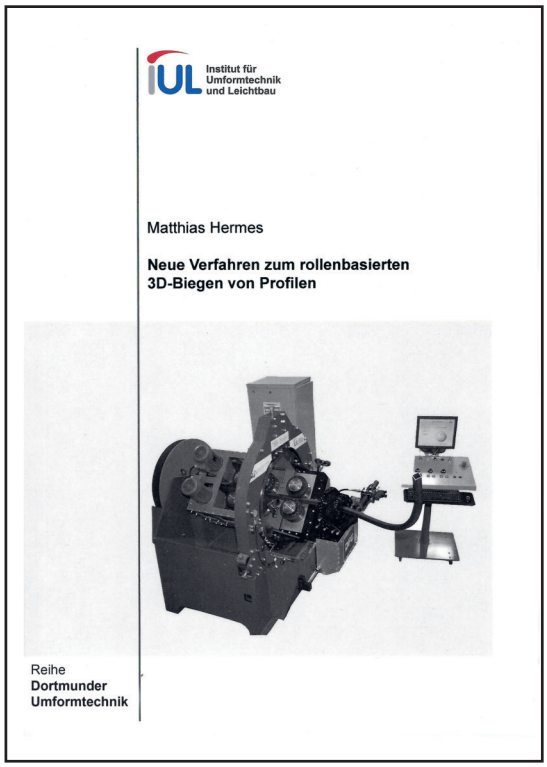
English version below

Institut für Umformtechnik und Leichtbau

Neue Verfahren zum rollenbasierten 3D-Biegen von Profilen

Matthias Hermes



Reihe Dortmunder Umformtechnik - Band 65

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Zusammenfassung

Due to the increasing demand of complex 3D bent parts made of tubes and profiles with arbitrary cross sections, different bending processes were developed within this work. These special parts have a high stiffness and a light weight, and at the same time a very aesthetical appearance. For the production of such workpieces a high flexibility is important to ensure an economic production in spite of the trend to smaller production lots. A kinematic forming process gives the chance to keep tool costs low. Furthermore, kinematic forming processes allow a metering of the process parameters to compensate varying material behaviors.

After a comprehensive literature research, the method of engineering design according to VDI 2221 was used to generate new bending process variants for spatial profile parts. The first result was the Incremental Tube Forming process, which is a combination of spinning and freeform tube bending that allows the production of bent tubes with a variation of diameter over the longitudinal axis at the same time. The second generated process was the TSS (Torque Superposed Spatial) bending process, which is a roll based 3D bending method for profiles with arbitrary cross sections.

The TSS bending process was further developed in this work. First of all a test machine was designed and built. General design rules were developed to allow the construction of other bending machine types to solve different bending problems. Moreover, a special control system was developed.

Within the aim to achieve a high bending accuracy, a process analysis was carried out to produce basic information. Under focus were the geometrical position of the forming zone and the interdependencies of the loaded and unloaded curvature during and after the bending process. The results of this work were used to develop an analytical model that was experimentally verified. Afterwards the stiffness of the machine was characterized. Based on these fundamentals a fast process planning system was worked out that makes it possible to generate bending data which include a spring back compensation. This tool could be successfully experimentally verified and allows the bending of 3D parts made of profiles with non-circular cross sections with high accuracy even in the first bending trial.

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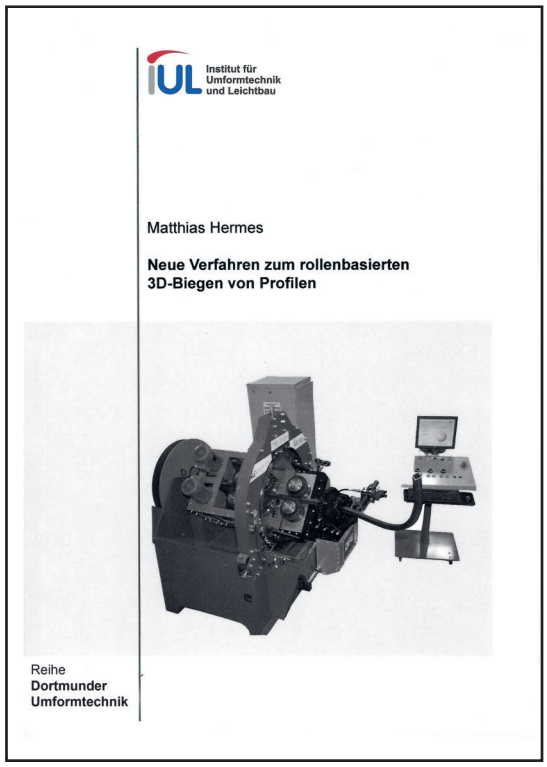
New processes for roll based 3D bending of profiles

Matthias Hermes



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