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## Inkrementelles Rohrformen von hochfesten Werkstoffen

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### Zusammenfassung

The usage of high strength steel grades is increasing continuously. Especially in the field of structural components these steel grades are used to support lightweight design. These structural components are often based on bent tubes with potentially varying cross sections.

In this work, a forming process is shown which allows the manufacture of bent tubes made of high strength steel. Besides the bending of tubes, the incremental tube forming process can also affect the diameter of the tube. Therefore, a bent tube with a varying cross section made of high strength steel can be manufactured within one process step. The incremental tube forming process is a process which combines a tube bending and a tube spinning process so that several process characteristics can be observed. This work focuses especially on the reduced bending moment as well as the reduced springback in comparison to a conventional bending process. Based on preliminary fundamental investigations, a new machine concept for incremental tube forming is presented. After that, the effect of the reduced bending moment as well as reduced springback is analyzed by means of numerical, experimental and analytical approaches. It is shown that these effects can be represented by the developed process model. Furthermore, the influence of the process on the wall thickness distribution is examined. It can be seen that the wall thickness can actively be adapted with the incremental tube forming process. Finally, application cases are presented which show the advantages of the process compared to conventional tube bending processes.

This work presents a fundamental research on the incremental tube forming process. The observed and examined effects of a process combination can further be applied to other forming processes using a process combination as well.

## Incremental tube forming of high-strength materials

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In this work, a forming process is shown which allows the manufacture of bent tubes made of high strength steel. Besides the bending of tubes, the incremental tube forming process can also affect the diameter of the tube. Therefore, a bent tube with a varying cross section made of high strength steel can be manufactured within one process step. The incremental tube forming process is a process which combines a tube bending and a tube spinning process so that several process characteristics can be observed. This work focuses especially on the reduced bending moment as well as the reduced springback in comparison to a conventional bending process. Based on preliminary fundamental investigations, a new machine concept for incremental tube forming is presented. After that, the effect of the reduced bending moment as well as reduced springback is analyzed by means of numerical, experimental and analytical approaches. It is shown that these effects can be represented by the developed process model. Furthermore, the influence of the process on the wall thickness distribution is examined. It can be seen that the wall thickness can actively be adapted with the incremental tube forming process. Finally, application cases are presented which show the advantages of the process compared to conventional tube bending processes.

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