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# Simulation and experimental research of the free bending process of a spatial tube

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**Abstract:** The free bending technology is regarded as a promising fabricating technology in the recent years. Due to characteristics of complex product shape and dieless forming, this technology arises more and more attention recently. Firstly, this paper analyzed movement track of bending die based on the principle of free bending technology. Then, distribution characteristics of equivalent stress and strain on tube and bending die during different stages of the free bending process were analyzed. Afterwards, this paper studied the influence law of clearance between tube and bending die, fillet radius of guider, feeding speed on the tube free bending quality. Relationship between eccentricity  $U$  of bending die and bending radius  $R$  of tube relates to the bending program directly. In this paper,  $U$ - $R$  relationship was obtained by finite element simulation to verify the accuracy of the built model. FE simulation and bending experiments were conducted based on the research results. The result revealed that dimension of the bent spatial tube was close to the CAD model and proved the reliability of  $U$ - $R$  relationship. Deviation of the bending radius and bending angle is supposed to occur due to springback after forming.

**Keywords:** free bending technology; spatial tube; forming quality; finite element simulation; forming experiments

## 1. Introduction

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