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# 单激励超声椭圆振动车削薄壁筒实验研究

李勋, 张德远

北京航空航天大学 机械工程及自动化学院, 北京 100083

# Research on Experiments of Single Actuator Driven Ultrasonic Elliptical Vibration Cutting Ultra-thin Wall Parts

LI Xun, ZHANG De-yuan

School of Mechanical Engineering and Automation, Beijing University of Aeronautics and Astronautics, Beijing 100083, China



**摘要** 通过对普通夹心式超声椭圆振动换能器结构的研究,设计了一种能够在单一纵向激励的情况下产生椭圆振动的换能器结构,利用有限元分析工具对换能器的结构进行分析,并且利用光纤测振仪对单一纵向激励换能器进行了测量,验证了可以通过单向激励产生椭圆振动。利用这种结构研制了一套单激励超声椭圆振动车削系统,采用PCD刀具对LY12实心件和薄壁筒工件进行了精密切削实验,实验结果表明椭圆振动切削可以大幅度降低切削力,明显改善薄壁工件的形状精度,同时工件还具有较好的表面粗糙度。

**关键词：** 薄壁件 车削 切削力 超声振动 PCD刀具

Abstract： In many fields of high-tech industry ultra-thin wall parts are employed. In this paper, an asymmetrical structural model of the ultrasonic elliptical vibration transducer only with the longitudinal driven is presented through analyzing the model of the longitudinal vibration transducer. A system of the ultrasonic elliptical vibration cutting with the single longitudinal animation was developed. With the polycrystalline diamond (PCD) tool, the precision ultrasonic elliptical vibration experiments were carried out on LY12 and ultra-thin wall parts. The results show that single actuator driven ultrasonic elliptical vibration cutting can reduce cutting forces and the deformation of the ultra-thin wall parts effectively, and the surface roughness of the workpiece is about $R_a$=0.09 μm.

Keywords： ultra-thin wall parts cutting cutting force ultrasonic vibration PCD tools

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