Introduction of JSPE Young Researcher Awards 2016

1. Shotaro TANAKA

Development of a Compensation Method of Setting Errors for High Efficient Multi-axis Control Ultraprecision Machining

J. JSPE, Vol.82, No.8, pp.758-763

Initial tool setting errors that could be generated while setting a cutting tool deteriorates machining accuracy. However, it is difficult to prevent an occurrence of the tool setting errors due to the manual setting process, which may increase in accordance with the number of the control axes. These errors make it difficult to locate tool control points at the right position while machining. Therefore, this study aims at detecting and compensating the setting errors without depending on operator's skill. A novel setting errors compensation method is proposed based on form shaping theory by using a dummy work and an on-machine measurement device. It is expected that the tool setting errors are compensated with high accuracy and efficiency because of automatic detection of the actual tool control points. From the conducted experiments, it is found that the proposed method has a potential to compensate the tool setting errors accurately and to achieve high efficient multi-axis control ultraprecision machining.

2. Sho MORITA

Development of the Design Method of Refractive-type Asymmetric Beam Shaping Optical Elements

J. JSPE, Vol.82, No.11, pp.983-988

A new design method for a refractive-type laser beam shaper with an asymmetric shape is proposed. This beam-shaping technique is useful in pattern marking (e.g., logo marking or character marking), and also in local heat treatment. These applications could be realized using high-power lasers with beam intensity converters. A refractive-type shaper is superior to a diffractive-type shaper for these applications because of its lower optical power loss and simple fabrication method, which involves only conventional machining processes such as milling, grinding, and polishing. For a desired beam pattern, the shaper form is designed automatically using iterative calculations by applying the behavior of electrically charged particles. The beam elements are assumed to possess the same polarity of charge, which generates a repulsive force depending on the intensity of electric charge and distance between elements. Furthermore, the desired pattern elements are assumed to possess contrary polarities, so that every beam element is effected of attractive force from all desired pattern elements. For no optical path crossing, the adjacent relations of elements are maintained throughout iterations. This design method was verified via testing in order to redistribute uniform collimated radiation into a single focused point. As a result, a paraboloidal surface was obtained, which performs the same function as a convex lens. Furthermore, the marking function was demonstrated by redistributing the character string “CIT” with 10,000 elements; the light pattern of the string was observed by the shaper.

3. So ITO

Uncertainty analysis of slot die coater gap width measurement by using a shear mode micro-probing system

Precision Engineering, Vol.43, pp.525-529

A shear mode micro-probing system was constructed for gap measurement of a precision slot die coater with a nominal gap width of 90 μm and a length of 200 mm. A glass micro-stylus with a nominal tip ball diameter of 52.6 μm was oscillated by a tuning fork quartz crystal resonator with its oscillation direction parallel to the measurement surfaces. An on-line qualification setup was established to compensate for the influences of the uncertainty sources, including the water layers on the measurement surfaces. The measurement uncertainty of the measured gap width was estimated to be less than 100 nm.

4. Wei HAN

Research on servo feed control of electrostatic induction feeding micro-ECM

Precision Engineering, Vol.45, pp.195-202

This paper researches about the machining characteristics and servo feeding control of micro electrochemical machining (ECM) with the electrostatic induction feeding method. Since current can flow only in the rising and falling time of pulse voltage, short pulses in the order of several tens of nanoseconds can easily be obtained, realizing significantly narrow gap widths. To avoid short circuit in the small working gap of several micrometers, a servo feeding control system based on monitoring the peak of gap voltage was developed. Compared with the old method, which monitors the average gap voltage, controllability of the working gap width with higher response was obtained because of the higher S/N ratio. The influence of the reference voltage on

the material removal rate (MRR) and machining accuracy was investigated. The results showed that higher MRR and smoother surface can be obtained with lower reference voltages, due to the higher current density in the working gap obtained with higher current efficiency. However, the MRR decreased when the reference voltage was too low, as a result of the interruption of machining by the frequent retreat of the tool electrode due to short circuit. On the other hand, the MRR increased with increasing feeding capacitance C1, because electric charge per each pulse duration increased in proportion to C1. The inlet side gap width was independent of C1, due to the higher MRR and shorter machining time with larger C1. Based on the preliminary study, through-holes of 50 μm in diameter were machined on a stainless steel (SUS304) plate with a thickness of 50 μm to investigate the straightness of the holes. The diameter of the hole at the inlet and outlet sides was 58.5 μm and 55.5 μm, respectively.

Introduction of The 38th Machine Tool Engineering Foundation Award

[Paper Award 2016]

Fundamental Study on Tapered Roller Screw —Design for Infinitesimal Slip and Verification of Mechanical Efficiency—

Hiroyuki YAMADA and Saku EGAWA

J. JSPE, Vol.82, No.5, pp.481-486

The roller screw mechanism is more suitable for high load than the ball screw mechanism, because it has a large contact area and a greater radius of curvature between a roller and a screw shaft. However, it is considered that the rolling mechanism which has large contact surface is easy to get a big slip ratio, and it generally has lower mechanical efficiency. In this study, to improve the mechanical efficiency of the roller screw mechanism, we devised the tapered roller screw mechanism (TRS). The shape of flank face of screw shaft and the surface of rollers of TRS is designed to minimize the slip ratio. As a result of experiment, it was confirmed that the apparent coefficient of friction was 0.0018 at minimum, and the mechanical efficiency was 0.985 at maximum. These results showed that the TRS was comparable to the ball screw mechanism in efficiency.

Call for Papers ICPE2018

About Conference

The 17th International Conference on Precision Engineering (**ICPE2018**) will be organized by the Japan Society for Precision Engineering (JSPE) on **12-16 November 2018 in Kamakura, Japan**. The conference will be held at Kamakura Prince Hotel located right off the shore of famous Shonan area.

The aim is to provide an international forum for experts to promote, share and discuss various issues and developments in the field of the precision and related engineering.

Conference Topics

ICPE 2018 focuses on the following topics.

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- Non-conventional machining
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- Machine tools
- Machining control
- Mechatronics / Robotics
- MEMS/NEMS
- Medical / Precision devices
- Tribological systems
- Measurement engineering
- Additive manufacturing
- Advanced moulding and forming
- Design engineering
- Service engineering
- Green manufacturing
- Other related technologies

Important Dates

Abstract submission	**Mar. 24, 2018**
Submit your abstract through the conference website: *http://icpe2018.jspe.or.jp/*	
Notification of abstract acceptance	Apr. 21, 2018
Full paper submission	Jun. 16, 2018
Notification of final acceptance	Aug. 25, 2018
Camera-ready manuscript	Sep. 15, 2018

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