

附件四、技術說明表



單點鑽石切削輪廓誤差預補償方法

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簡歷： (可列出相關連結，例如系所、研究室網頁)

學歷：

東京大學工學博士

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相關連結：

國立台灣大學機械工程學系-師資簡介-蔡曜陽：

http://www.me.ntu.edu.tw/main.php?mod=adv_custom_page&func=show_page&site_id=0&page_id=184

市場及需求:

現今使用單點鑽石切削的加工廠商，為了達到納米級加工精度，設置步驟包括：切削標準工件校刀，調整刀具座標與刀鼻半徑設定值；以及反覆試切產品，並依照工件輪廓誤差補償刀具路徑。由於超精密切削速度非常慢，是一般切削的數十倍，任何試切都非常費時。尤其機台昂貴（千萬起跳），減少架設時間非常重要。而本技術可以直接免去試切的步驟，大幅減少架設時間。

技術摘要(含成果):

本技術使用「校刀」時的工件輪廓誤差，利用訊號處理與座標轉換，預先補償「產品」刀具路徑，免去試切步驟。本技術有完整的預補償系統，包括為了此方法而特別設計的校刀用工件，還有從工件輪廓重建刀鼻輪廓，並計算預補償路徑的程式與方法。

經反覆實驗與廣泛討論各項變數，可以再使用波紋度超過 600 nm（業界要求十倍以上）的刀具，不試切下也可保證工件輪廓誤差小於於 65 nm，甚至可做到小於 40 nm。實際精度極限決定於現場量測設備，使用較新型量測設備，有望小於 20 nm。

優勢:

精度極高可達數奈米，至少比市面上產品少 2 個數量級

競爭產品:

FormEye (Shibaura Machine)

專利現況:

專利申請中

聯絡方式(請不用填):

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Pre-Compensating Method of Profile Error for Single Point

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Experience:

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Market Needs:

To achieve nanometer-level precision, modern manufacturers utilizing single-point diamond cutting follow several steps. These include calibrating tools by cutting standard workpieces, adjusting tool coordinates and nose radius settings, and conducting repeated test cuts. The test cuts are used to compensate for any contour errors in the workpieces by adjusting the tool path accordingly. Due to the extremely slow feed rate, which is several times slower than conventional cutting, any test cuts are time-consuming. Given the high cost of the machines (starting at tens of millions), minimizing setup time is crucial. This technology eliminates the need for test cuts, significantly reducing setup time.

Our Technology:

This technology utilizes signal processing and coordinate transformation to pre-compensate for the tool path, based on the workpiece contour errors identified during calibration. This approach eliminates the need for test cuts. The technology includes a comprehensive pre-compensation system, featuring specially designed calibration workpieces, methods for reconstructing the tool nose contour from the workpiece profile, and programs for calculating the pre-compensation path.

Through repeated experiments and extensive analysis of various parameters, it has been demonstrated that even using tools with a waviness exceeding 600 nm (ten times the industry standard), workpiece contour errors can still be kept below 65 nm without test cuts. It is even possible to achieve errors below 40 nm. The ultimate precision limit depends on the on-site measurement equipment, with newer equipment potentially achieving errors below 20 nm.

Strength:

The accuracy is extremely high and can reach several nanometers, which is at least 2 orders of magnitude less than products on the market.

Competing Products:

FormEye (Shibaura Machine)

Intellectual Properties:

Patent pending

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