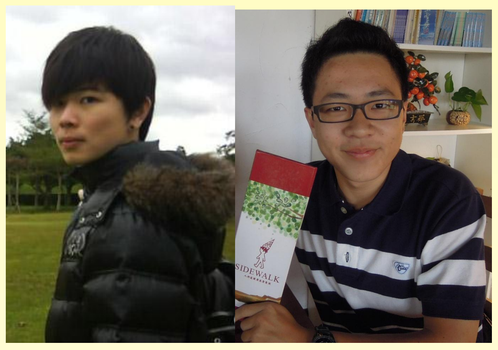
101年大學部國際交流甄選專題成果展



Dimensional Calibration of Three-Axis Micro-Manufacturing Based on Two-photon polymerization Technique

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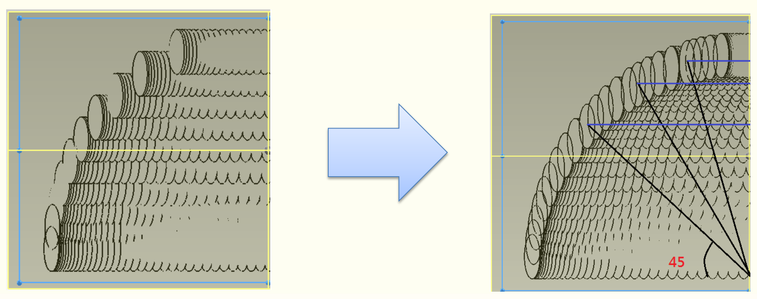
Researchers: Po-Chieh Chang、Tzu-Hsuan Fu
Advisor: Chao-Yaug Liao

Abstract

Our project is about the Dimensional Calibration of Three-Axis Micro-Manufacturing Based on Two-photon polymerization Technique. Because there exist some accuracy problems when using three-axis machine to do manufacturing. So we use Solidworks and Materialise Magic to calibrate the dimensional parameters.

Method

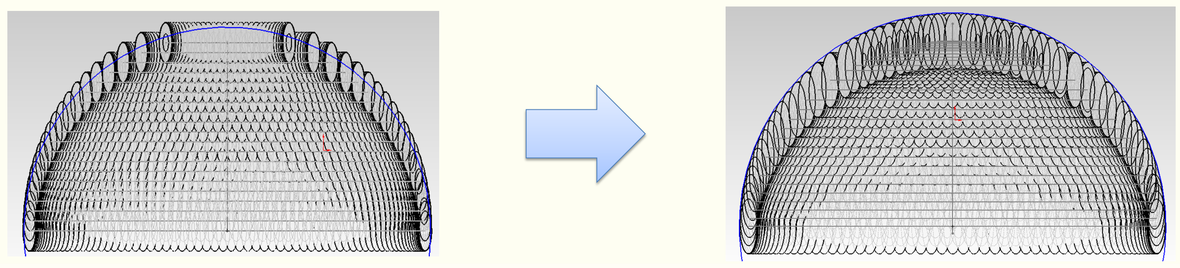
Solving unconnected problem



Same layer thickness

Different layer thickness

Solving unexpected shape problem



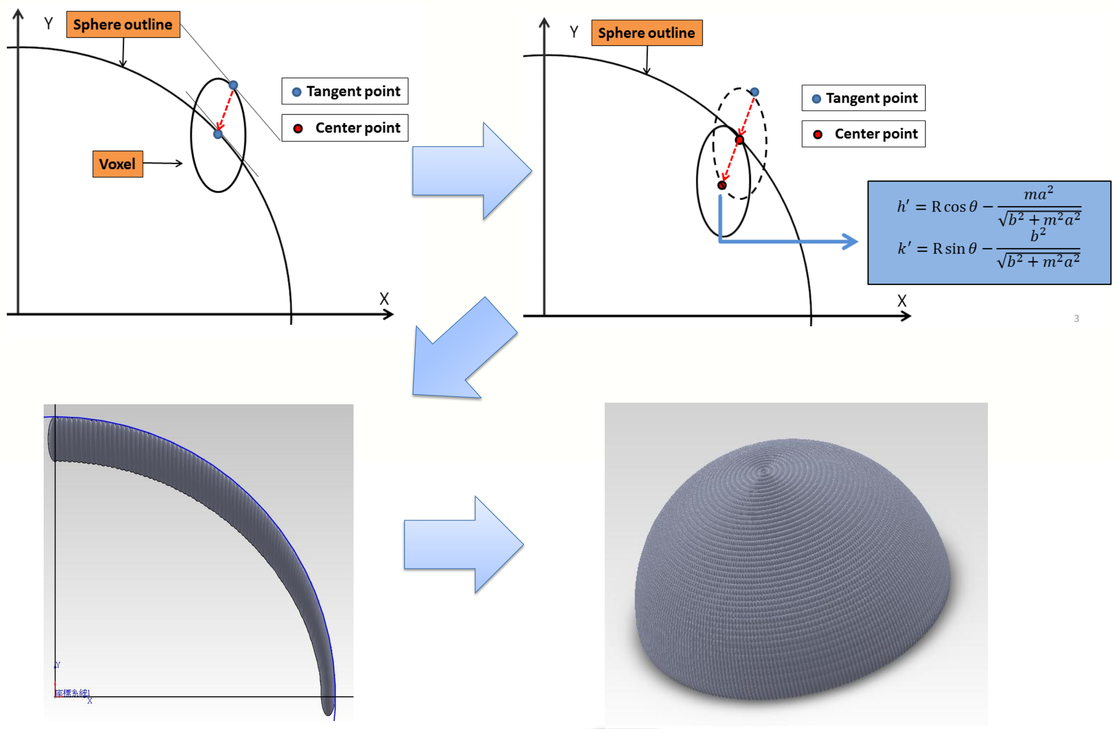
Shifting position of center point

Result

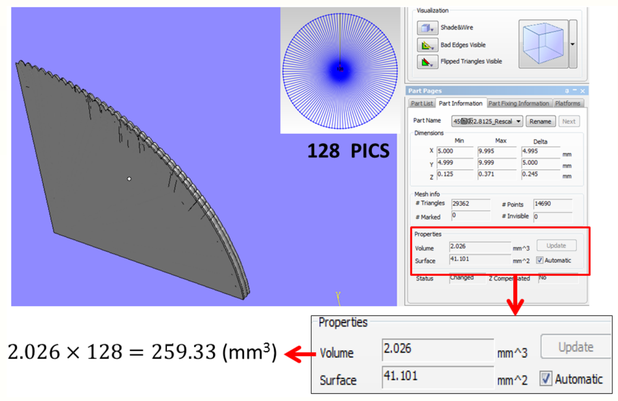
Tangent equation of ellipse : $y - k = m(x - h) \pm \sqrt{a^2m^2 + b^2}$

Equation of ellipse : $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Parameter of sphere : $\begin{cases} m = \cot\theta \\ x = R\cos\theta \\ y = R\sin\theta \end{cases}$

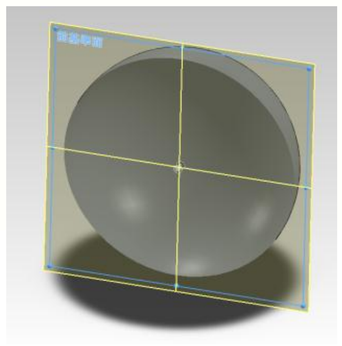


Divide a semi-sphere in to 128 pic in equal, and use materialise magic for simulation the volume parameter, and multiply the result with 128 we can get the total volume.



$2.026 \times 128 = 259.33\ (mm^3)$

The volume error of semi-sphere will decrease when using our calibration formula.



Cross section view of sphere

R=5mm	Theoretical value	Non-adjusted	Adjusted
Volume	261.80 (mm^3)	296.49 (mm^3)	259.33 (mm^3)
Error	0	13.25%	> 0.94%

Conclusion and Future work

Although it still have some error ,but it prove that our method is useful on dimensional calibration.
In the future ,we are going to reduce the error and calculate the formula to fit in any condition.
And use Solidworks API system to do further automatical calibration.