高精度雙曲面研磨研究
A Study of Grinding on the Precision Hyperbolic Revolution Surfaces

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摘 要

雙曲面為一雙曲線繞軸線旋轉而形成，雙曲面從一個焦點發出的光
線經雙曲線反射的反射線必過另一焦點。相反的路徑仍然成立，因其具備特
殊的光學性質而被廣泛應用。如用於大型場地的遮光照明、微波通信中常用
的天線及望遠鏡等等。

本文將以刀具或砂輪偏轉一角度，精準的計算由最小殘留高度逆算求得
切削加工中的步進距離及進刀量，再由步進距離與進刀量求得各輪的進給，
以此方法可加工研磨雙曲面曲面。可節省許多從前用人工研磨的部份，
不但可節省人力與經費並可提高研磨精度，以科學的方法達到業界的需求。

本文探討新的硬脆光學材料的超精密研磨技術加工方法。克服研拋加工
的效率低，成本高等缺點。小面積生產可能用手工長時間連續拋光完成所需
的精度，大面積雙曲面很難用同樣方法拋光完成所需的精度。對大面積雙曲
面而言用數控研磨直接拋光可達到經濟效果。本文探討新的研磨方法及理
論，為雙曲面生產製造具有重要參考價值。

關鍵詞：雙曲面曲面、殘留高度、曲率
Abstract

A hyperbola turn round symmetrical axis results in hyperbolic revolution surface. Hyperbolic revolution surfaces are provided with which the lights issue from a focus to pass through hyperbola and reflect lights to pass through other focus. Opposite paths are still established. Using this property of optics generally put in use to lamplight of large-scale location, antenna of microwave communication, telescope and so on.

This paper will use as a mill or a grinding wheel deflection an angle and count of precision. This paper uses the minimum residual height to obtain the stepping and feed distances of cutting. The stepping and feed distances of cutting obtain moving of every axis of NC machine. This method can manufacture and grind hyperbolic revolution surfaces and economize the use of the grind of working done by hand. This method doesn’t economize only the use of the grind of working done by hand and funds for operation, but also improves the precision of grind. The feasibility of the theory and the method will be verified.

A research of precision grinding design on this paper, whereas rotational symmetry causes the manufacture of such optical elements made of brittle materials considerably more difficulty, so these elements are expensive and rare. Small production may be hand polished by continuous test till the desired surface is obtained. Large volume production of not too large size hyperbolic elements is often achieved through replication processes. However for large size elements NC machines may make it economical to directly manufacture. Comprehensive and useful reference data are thus offered for the manufacture of production of this kind of mirrors.

Keywords: hyperbolic revolution surfaces, residual height, curvature