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## 闭式整体叶盘通道五坐标分行定轴加工刀轴矢量规划方法

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### Tool Axis Orientation Planning Method of Fixed Axis in Each Cutting Line for Closed Blisk Tunnel Five-axis Machining

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摘要

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**摘要** 闭式整体叶盘是新一代航空发动机实现减重增效的关键零件,其通道结构属于典型多约束复杂通道结构。针对闭式整体叶盘通道精加工,提出了一种基于五坐标分行定轴加工的刀轴矢量规划方法。从加工原理上给出了分行定轴加工方法的基本概念,并分析了闭式整体叶盘通道五坐标加工的特征;在刀具预定义和建立检查面球体包围盒层次树结构的基础上,给出了刀轴矢量无干涉区域的计算方法;基于刀位点最短刀长的计算与分析,进行了叶盘通道加工区域划分,建立了分行定轴加工刀轴矢量规划方法。实验验证表明:分行定轴相对五轴联动加工方法不仅可明显提高加工过程中的稳定性和叶片加工表面质量,还可提高叶片精加工效率。

**关键词:** 闭式整体叶盘 刀轴矢量 五坐标数控加工 分行定轴 干涉判断

**Abstract:** The closed blisk of an aeroengine plays a key part in the improvement of the thrust-to-weight ratio of the new generation aeroengine, and its tunnel structure is a typical complex tunnel structure with multi-constraints. This paper proposes a new tool axis orientation planning method based on the fixed axis in each cutting line machining for closed blisk tunnel finish machining. The basic concept of the method is discussed from the machining principle, and the five-axis machining features of the closed blisk tunnel are analyzed. The calculation method of the tool axis orientation interference free domain is given based on predefining the tool and establishing the bounding sphere hierarchy tree structure of the check surface. The division of the blisk tunnel machining region is made based on the calculation and analysis of the shortest tool length of cutter location points, and the tool axis orientation planning method of fixed axis in each cutting line machining is established. Experimental results demonstrate that, compared with the five-axis linkage machining method, the fixed axis in each cutting line not only significantly improves the stability of machining and the quality of the machined blade surface, but also improves the blade finish machining efficiency.

**Keywords:** closed blisk tool axis orientation 5-axis NC machining fixed axis in each cutting line gouging detection

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