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基于动态Bayesian网络的叶片加工质量监控与溯源

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Machining Quality Monitoring of Blades and Source Tracing Based on Dynamic Bayesian Network

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摘要

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摘要 针对叶片加工过程中质量精度不高的问题,提出了基于动态Bayesian网络的叶片加工质量监控与溯源方法.利用动态Bayesian网络建立起叶片加工工序间的相互联系,实现对整个加工过程的控制.基于Bayesian网络对影响加工工序的因素集建立因果联系,采用多元统计过程控制中的 T^2 控制图完成对各工序影响因素集的监控,进行误差溯源时,根据Bayesian网络建立的因果关系对失控样本的 T^2 统计量依据原因变量进行误差分解,并构建各分解变量的控制限,将其作为误差源判定的条件.通过对某叶片加工过程的仿真,验证了所提方法的有效性.

关键词: 航空发动机 叶片加工 质量监控 误差溯源 动态Bayesian网络 误差分解

Abstract: A methodology of monitoring the machining quality of blades and tracing the error source based on dynamic Bayesian network is proposed for solving the low accuracy of blade machining quality. Dynamic Bayesian network is used to establish the relationship between blade machining operations to realize the control of the whole machining process. The causal relation between the elements in the main process factor set that affects blade machining operations is built by Bayesian network. The control chart T^2 is used to monitor the factor set of each operation to judge whether the operation is out of control or not. While tracing error sources, the T^2 statistics of the samples out of control are decomposed according to causal variables described by aforementioned causal relation, and the decomposed variable control limits are built as error source judgment conditions are built. A simulation study on a blade machining process is carried out, which demonstrates that the proposed method is reasonable.

Keywords: aeroengine blade machining quality monitoring error source tracing dynamic Bayesian network error decomposition

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