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基于多源诊断信息融合的发动机气路分析

Gas path analysis based on multi-sources diagnostics information fusion

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中文摘要:

针对气路可测信息的有限性及不确定性易导致航空发动机气路分析结果准确度和精度不高的问题, 提出了一种基于贝叶斯网络的多源诊断信息融合机制, 以提高气路部件故障诊断的准确度和精确度. 介绍了基于贝叶斯网络的气路分析方法, 在此基础上提出了改进的用于多源诊断信息融合的气路分析贝叶斯网络, 即以常规的气路可测参数为主, 而其他诊断信息则借助故障模式先验概率表引进贝叶斯网络, 实现多源信息的融合. 仿真实验表明: 通过融合多源信息能够准确地诊断出传统的气路分析难以识别的故障, 同时降低了健康参数估计值的方差, 提高了诊断结果的精确度; 在观测噪声放大一倍、健康参数变化量小于1%的情况下, 通过融合多源信息仍能准确的估计出健康参数变化量, 且标准差均于0.1%.

英文摘要:

Considering the poor accuracy and precision of the gas path analysis (GPA) results due to lack of enough measured gas path parameters and the associated uncertainty, a Bayesian network based multi-source diagnostics information fusion mechanism was proposed to improve the performance of the GPA. The Bayesian network based GPA (BN-GPA) was introduced briefly, then an improved BN-GPA was developed to incorporate diagnostics information from multi sources. In the framework based on the diagnostics information inferred from the measured gas path parameters, other diagnostics information was incorporated into the Bayesian network by the fault mode prior probability table. The results of the simulation show that by fusing the multi sources information, the fault mode which cannot be identified by the traditional GPA now can be identified accurately with reduced variance for the estimation of the health parameters; In another case where the standard deviation of the measurement noise is doubled and the deviations of the health parameters of the faulty components are set less than 1%, the estimation results of the health parameters are still relative accurate with the standard deviation of the estimation result less than 0.1%.

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