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杨洲, 景博, 张劼. 航空发动机健康评估变精度粗糙集决策方法[J]. 航空动力学报, 2013, 28(2): 283~289

航空发动机健康评估变精度粗糙集决策方法

Variable precision rough set decision-making method for health assessment of aero-engine

投稿时间: 2012-03-22

DOI:

中文关键词: [健康评估](#) [航空发动机](#) [变精度粗糙集](#) [交叉信息熵](#) [相似性度量](#)英文关键词: [health assessment](#) [aero-engine](#) [variable precision rough sets](#) [cross-entropy](#) [similarity measurement](#)

基金项目: 航空科学基金(20101996012); 预研基金

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中文摘要:

针对航空发动机健康评估过程中存在的多工况、非线性和小子样问题, 提出了一种基于相似性度量的发动机健康评估的变精度粗糙集决策方法. 首先给出了变精度粗糙集中正确分类率的确定原则和方法, 提取了决策规则; 其次, 提出了基于交叉信息熵的属性相对重要度计算方法, 并给出了属性的客观权重, 结合专家经验和运行工况形成了属性的综合权重; 最后, 提出了基于属性综合权重的加权相似性度量方法, 通过比较当前对象与约简后的决策系统中所有对象的相似程度, 给出决策结果, 完成对发动机的健康评估. 实例表明, 在结合专家经验和运行环境对评估结果进行修正后, 该方法对发动机的健康评估更贴近实际, 方法具有一定的普适性.

英文摘要:

In order to solve the problems of variable working condition, non-linear and small sub-sample in the process of aero-engine health assessment, a variable precision rough set decision-making method based on the similarity measurement was proposed. Firstly, the principle and method of choosing value was given, and the decision-making rules were extracted. Secondly, the method of calculating attributes' relative importance based on cross-entropy was proposed and attributes' objective weights were given. Taking the expert experience and working experience into account, overall weights were formed. Finally, a weighted similarity measurement based on the overall weight of attributes was developed. By comparing the similarity degrees between the current object and other objects from the reduced decision-making system, the decision results were given. Simulation results show that the method is effective to aero-engine's health assessment with the help of expertise and running environment. In addition, the proposed method can be applied to other regions.

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