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# 发动机故障诊断的主成分算法

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# PRINCIPAL COMPONENT ALGORITHM FOR AERO ENGINE FAULT DIAGNOSIS

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摘要 给出了两种基于主成分分析的发动机故障诊断算法，即主成分估计算法和主成分降维算法。这两种算法可以有效地解决发动机故障诊断中的两个技术难点，即减少故障方程中故障因子的个数以及克服故障方程的多重共线性的不良影响. 在主成分估计算法中提出了最优主成分个数的概念，解决了主成分个数选择的难题. 还以J T 9 D发动机故障诊断问题为例说明主成分分析算法的应用。研究结果表明，利用主成分降维方法可以将J T 9 D发动机的2 6个故障因子压缩到9个，或者将5个单元体的1 0个故障因子缩减到5个综合变量。所给出的两种算法可以在故障方程存在严重多重共线性而又无约束条件可供利用的情况下给出满意的故障诊断结果。

关键词： 发动机 故障诊断 主成分分析 最优化方法

Abstract： Two algorithms for aero engine fault diagnosis based on principal component analysis are presented. The principal component estimate algorithm(PCEA) and the principal component dimension reduction algorithm (PDRA). These algorithms can resolve efficiently the two difficult problems in aero engine fault diagnosis, e.i., reduce the number of fault factors in the fault equation, and improve its abnomal condition. The concept of optimum principal component number and its determination for the PCEA are presented in the paper, which resolves the difficult poblem of selecting the number of principal components. The application of the given algorithms is demonstrated for JT9D engine diagnosis. Investigation shows that the 26 fault factors of JT9D engine can be reduced to 9, or the 10 fault factors of 5 engine modules can be reduced to 5 combined variables, and satisfactory results can be obtained by use of these algorithms in the case that serious multi collinearity exists in the fault equation and no constrained conditions are available. As a middle link of Primary Factor Model and Random Search Model presented by the authors, these algorithms can be used in the case that the fault pattern number is greater than the measurement number.

Keywords： aer o engine fault diagnosis principal component analysis opt imization

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