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非线性分离算法及其在飞行试验中的应用

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A SEPARATED ALGORITHM AND APPLICATIONS TO FLIGHT TEST

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摘要

本文根据最小方差估计和分离算法原理,提出一种新的非线性状态估计和偏差辨识的分离算法。并用此算法确定飞行状态和测试仪器的误差,同时U-D分解保证计算效率和数值稳定性。为了得到数据相容性检验的准确结果,本文采用直接离散化的飞机运动模型,以减小模型误差。通过仿真并在我国两种歼击机上实际应用,结果表明本文所给的算法对不同的初值和噪声统计特性都能得到飞行数据相容性检验的一致结果,并能用于低采样率下的数据相容性检验。

关键词： 非线性滤波 偏差辨识 数据处理 飞行试验

Abstract:

In order to determine aircraft performance stability and contrdl characteristics from test data, flight stale estimation is needed.Usually, extended, Kalman filter and fixed-interval smoother are used for handling the nonlinear estimation problems of both the state and parameter.However, practical experience and theoretical studies show that this augmented algorithm, in fact, is not satisfactory for parameter estimation.In order to provide a more accurate and practical method for flight state estimation, this paper presents a new separated bias identification and state estimation algorithm which is used for both the flight state estimation and instrumentation errors identification.In order to get high accuracy, U-D factorization methods are applied to improving the computational stability and efficiency. Discrete-time model of aircraft motion used for decreasing modeling errors.Finally, this new approach has been compared with the conventional method by digital simulation and actual flight test data compatibility check.The results calculated show that the new method can give more consistent results than the usual one for a different initial values and the noise statistics.Moreover, this approach can be used for the compatibility check of lower sampled flight test data.

Keywords: nonlinear filter bias identification data processing flight test

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