應用適應性演算法則於旋轉機械之故障診斷

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摘 要

本論文主要是利用適應性的遞迴式最小平方法(Recursive Least-Square)、卡爾曼(Kalman)和可變的收斂因子仿射投影演算法(Variable Step-Size Affine-Projection Algorithm)的理論於階次分析 的故障診斷技巧上，階次分析的技巧對於轉動機械的故障診斷而 言是一種非常重要工具。傳統故障診斷方法是利用傅立葉分析的 技巧伴隨轉軸的轉速來檢測機械的損壞，然而在轉軸轉速變化的 情形下，再取樣過程(Resampling)常被用於取捨時、頻域上的解 析度。此方法有一些缺點，尤其是相鄰近階次與相交越階次上， 存在有頻率抹平(Frequency Smearing)的現象。而本研究是利用高 解析的遞迴式最小平方法、卡爾曼和可變的收斂因子仿射投影演 算法之階次分析的方法於齒輪之故障診斷，且這些濾波器可以克 服傳統故障診斷於變轉速上會發生頻率抹平的問題。工作內容是 將振動訊號經過遞迴式最小平方法、卡爾曼與可變的收斂因子仿 射投影演算法做階次追蹤而得到所需的特徵值，藉此判斷是否有 故障產生。而在實驗完成之後，高解析的階次振幅可以被計算出， 且同時完成高解析的階次分析系統於各種不同情況之齒輪損壞的 評估。從實驗結果可以得知，應用這些適應性濾波器於齒輪之故 障診斷確實有其效果。

關鍵詞 : 故障診斷，階次分析，遞迴式最小平方法，卡爾曼， 可變的收斂因子仿射投影演算法

目錄

參考文獻

[1] E. Y. Chow and A. S. Willsky, 1984, “ Analytical redundancy -and the design of robust failure detection systems, ” IEEE -Transaction on Automatic Control, Vol. 29(9), pp. 603-614.

[2] P. M. Frank, 1990, “ Fault diagnosis in dynamic system using -analytical and knowledge-based redundancy: A survey and -some new results, ” IEEE Transaction on Automatic Control, -Vol. 26(5), pp. 459-474.

[3] R. Isermann, 1991, “ Process fault diagnosis based on process -model knowledge – part 1: Principles for fault diagnosis with -parameter estimation, ” ASME Journal of Dynamics System, -Measure Control, Vol. 113, pp. 620-626.

[4] R. Isermann, 1991, “ Process fault diagnosis based on process -model knowledge – part 2: Principles for fault diagnosis with -parameter estimation, ” ASME Journal of Dynamics System, -Measure Control, Vol. 113, pp. 627-633.

[5] J. Lin and L. Qu, 2000, “ Feature extraction based on morlet -wavelet and its application for mechanical fault diagnosis, ” -Journal of Sound Vibration, Vol. 234, pp. 135-148.

[6] M. Biswas, A. K. Pandey, S. A. Bluni and M. M. Samman, -1994, “ Modified chain-code computer vision techniques for -interrogation of vibration signatures for structural fault -detection, ” Journal of Sound Vibration, Vol. 175, pp. 89-104.

[7] K. Shibata, A. Takahashi and T. Shirai, 2000, “ Fault diagnosis -of rotating machinery through visualization of sound signals, ” -Mechanical

System Signal Process, Vol. 14, pp. 229-241.
[8] Y. D. Chen, R. Du and L. S. Qu, 1995, " Fault features of large -rotating machinery and diagnosis using sensor fusion, " -Journal of Sound Vibration, Vol. 188, pp. 227-242.
[9] G. Gelle, M. Colas and C. Serviere, 2001, " Blind source -separation: a tool for rotating machine monitoring by vibration -analysis, " Journal of Sound Vibration, Vol. 248, pp. 865-885.
[10] H. Vold and J. Leuridan, 1993, " High resolution order tracking -at extreme slew rates, using Kalman filters, " SAE Paper, -Number 931288, pp. 219-226.
[11] H. Vold, M. Mains and J. Blough, 1997, " Theoretical -foundations for high performance order tracking with the -vold-Kalman tracking filter, " SAE Paper, Number 972007, pp.1083-1088.
[12] S. Haykin, 1996, " Adaptive filter theory, " Prentice-Hall, New Jersey.
[13] M. R. Bai, J. Jeng and C. Chen, 2002, " Adaptive order -tracking technique using recursive least-square algorithm, " -Transaction ASME, Journal of Vibration Acoustic, Vol. 124, pp. 502-511.
[14] M. R. Bai, J. Jeng and C. Chen, 2003, " Adaptive Order -Tracking Technique using Recursive Kalman Filtering, " -ASME, Journal of Vibration Acoustic, (to appear).
[15] S. H. Leung and C. F. So, 2001, " Variable forgetting factor -nonlinear RLS algorithm in correlated mixture noise, " IEEE -Electronics Letters, Vol. 37, pp. 861-862.
[16] S.W. Song, J. S. Lim, S. J. Baek and K. M. Sung, 2000, - " Variable forgetting factor linear least squares algorithm for a -frequency selective fading channel estimation, " Journal of -Acoustics and Signal Processing, Vol. 5, pp. 2673-2676.
[17] R. S. Bucy, 1967, " Global theory of the Riccati equation, " -Journal of Computation System Science, Vol. 1, pp. 349-361.
[18] S. G. Sankaran and A. A. Beex, 2000, " Convergence behavior -of affine projection algorithms, " IEEE Trans. Signal -Processing Vol. 48, pp. 1086-1096.
[19] R. W. Harris and D. Chabries, F. Bishop, 1986, " A variable -step (VS) adaptive filter algorithm, " IEEE Trans. Acoustics, -Speech, and Signal Processing , Vol.34. pp. 309-316.
[20] T. Aboulnasr and K. Mayyas, 1997, " A robust step-size -LMS-type algorithm: analysis simulations, " IEEE. Trans. -Signal Processing, Vol.45, pp. 631-639.
[21] R. H. Kwong and E. W. Johnston, 1992, " A variable step size -LMS algorithm, " IEEE Trans. Signal Processing. Vol. 40, pp. 1633-1641.
[22] P. Sristi, W. S. Lu and A. Antoniou, 2001, " A new variablestep- -size LMS algorithm and its application in subband -adaptive filtering for echo cancellation, " Proc. IEEE ISCAS 01 -Vol. 2 pp. 721-724.