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A New Signal Processing Method Based on Notch Filtering and Wavelet Denoising in Wire Rope Inspection

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Abstract: *Wire rope is a necessary tool in practical applications especially in crane, elevator and bridge construction, which plays an important role in the national economy and daily life, and safety inspection for wire rope is the key to ensure people's life and property. However, detection signals are usually complicated due to the twining structures, which make the wire rope defect signal and strand signal mix together. What's more, no reports and studies have appeared to solve this problem. In view of the situation and challenges above, this paper proposes a combined signal processing method based on notch filtering and wavelet denoising to process detected wire rope signals. Basic time domain, frequency domain and joint time–frequency analysis are first conducted, thereafter, conventional signal processing methods such as low-pass filtering and adaptive analysis are presented according to the signal characterizations. These comparisons and results demonstrate that a conventional single method is incapable of wire-rope-detection signal identification and differentiation. Nonetheless, after the notch filter design and calculation, the processing results for the typical wire rope inspection signals in the experiments indicate that the combined methods can not only distinguish steel wire rope defect signal and strand signal effectively but also with high detection accuracy, even for the inner defect. Finally, the feasibility and reliability are verified by a series of signal processing results and comparisons, which demonstrate that this new method has great application potential and is of vital significance to the development of wire rope safety inspection.*

Keywords: Wire rope - Signal processing - Notch filter - Wavelet denoising - Strand signal - Defect signal

REFERENCES

[1]. Kalwa, E., Piekarski, K.: Design of inductive sensors for magnetic testing of steel ropes. NDT Int. 20(6), 347–353 (1987)
[2]. Casey, N., White, H., Taylor, J.: Frequency analysis of the signals generated by the failure of constituent wires of wire rope. NDT Int. 18(6), 339–344 (1985)
[3]. Rizzo, P., di Scalea, F.L.: Ultrasonic inspection of multi-wire steel strands with the aid of the wavelet transform. Smart Mater. Struct. 14(4), 685 (2005)
[4]. Kerschen, G., Lenaerts, V., Marchesiello, S., Fasana, A.: A frequency domain versus a time domain identification technique for nonlinear parameters applied to wire rope isolators. J. Dyn. Syst. Meas. Contr. 123(4), 645–650 (2001)
[5]. Rizzo, P., Di Scalea, F.L.: Wave propagation in multi-wire strands by wavelet-based laser ultrasound. Exp. Mech. 44(4), 407–415 (2004)
[6]. Song, E., Shin, Y.-J., Stone, P.E., Wang, J., Choe, T.-S., Yook, J.-G., Park, J.B.: Detection and location of multiple wiring faults via time–frequency-domain reflectometry. IEEE Trans. Electromagn. Compat. 51(1), 131–138 (2009)
[7]. Allen, R.L., Mills, D.: Signal Analysis: Time, Frequency, Scale, and Structure. Wiley, New Jersey (2004)
[8]. Jomdecha, C., Prateepasen, A., Methong, W.: Characterization of wire rope defects from magnetic flux leakage signals. Thammasat Int. J. Sci. Technol. 8(1), 54–63 (2003)

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[9]. Welch, P.: The use of fast Fourier transform for the estimation of power spectra: a method based on time averaging over short, modified periodograms. IEEE Trans. Audio Electroacoust. 15(2), 70–73 (1967)

[10]. Bendat, J.S., Piersol, A.G.: Engineering applications of correlation and spectral analysis, p. 315. Wiley-Interscience, New York (1980)