Novel Wavelet Threshold Denoising Method in Axle Press-Fit Zone Ultrasonic Detection

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Axles are important part of railway locomotives and vehicles. Periodic ultrasonic inspection of axles can effectively detect and monitor axle fatigue cracks. However, in the axle press-fit zone, the complex interface contact condition reduces the signal-noise ratio (SNR). Therefore, the probability of false positives and false negatives increases. In this work, a novel wavelet threshold function is created to remove noise and suppress press-fit interface echoes in axle ultrasonic defect detection. The exponential threshold function proposed by Andria [1] can't get a gradual curve for later optimum searching process; and the novel wavelet threshold function with two variables is designed to ensure the precision of optimum searching process. Based on the positive correlation between the correlation coefficient and SNR [2] and with the experiment phenomenon (shown in Fig. 2) that the defect and the press-fit interface echo have different axle-circumferential correlation characteristics, a discrete optimum searching process for two undetermined variables in novel wavelet threshold function is conducted. The performance of the proposed method is assessed by comparing it with traditional threshold methods using real data. The statistic results of the amplitude and the peak SNR of defect echoes show that the proposed wavelet threshold denoising method not only maintains the amplitude of defect echoes but also has a higher peak SNR.

**Figure 1.** Noisy B-scan with 3 defects. **Figure 2.** Different correlation coefficients depend on different intervals of 2 A-scans. **Figure 3.** B-scan denoised by proposed method.

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References: