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FAST WAVELET INSTANTANEOUS CORRECTION AND ITS APPLICATION TO ABNORMAL SIGNAL DETECTION

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Abstract. *In this study, in order to improve the effectiveness of abnormal signal detection, we first develop a novel parasitic discrete wavelet transform (P-DWT) to perform fast wavelet instantaneous correlation (F-WIC) and then propose a new design method of parasitic filters that corresponds to the real signal mother wavelet by using the lifting scheme and the optimization method for the P-DWT. Finally, we apply the F-WIC to car rattle noise source identification and show that our method can improve computational efficiency and obtain sufficient calculation accuracy at the same time.*
Keywords: Wavelet transform, Abnormal detection, Sound, Vibration, Time-frequency analysis

1. **Introduction.** It is well known that wavelet transforms (WT) are used widely as time-frequency analysis methods since they express the features of an unsteady signal clearly in the time and frequency plane [1, 2]. Therefore, the WT has been applied to signal processing in various fields, and has received significant attention [3].

The wavelet transform uses the dilation a and translation b of a single wavelet function $\psi(t)$ called the *mother wavelet* (MW) to analyze all different finite energy signals. It is able to be divided into the continuous wavelet transform (CWT) and discrete wavelet transform (DWT) based on the variables a and b which can be continuous or discrete values. For the CWT, all functions can be used as the MW if they satisfy the admissibility condition [4] and many types of MWs, for example, the complex type and real type, have been proposed[5]. Understandably, different analysis results are obtained when using different MWs. So, in signal analysis, one often has to first examine the characteristics of the MWs before choosing one. For example, when analyzing an unfamiliar signal, the Gabor function [4] and the RI-Spline wavelet [6] generally produce better results than other wavelets since they have better localization in the frequency and time domain, and easily match the frequency and time of the signal.