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DENOISING OF ON-LINE PARTIAL DISCHARGE SIGNAL FROM HIGH-VOLTAGE ROTATING MACHINES USING STANDARD DEVIATION THRESHOLD

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Abstract. *Recently, the increasing importance of reliable electric power supply has brought greater focus on on-line diagnosis of power equipment. A major cause of faults in high-voltage rotating machines is insulation breakdown in the stator winding. Thus, on-line diagnosis of the stator winding insulation is critical. For this, on-line detection of partial discharge is most commonly implemented by using a capacitive coupler at the stator winding. This paper proposes a denoising algorithm for the on-line partial discharge signal using a feature that considers the standard deviation of noise and the partial discharge signal. The proposed algorithm comprises a primary wavelet denoising scheme and a secondary scheme that is based on the standard deviation of white Gaussian noise. The algorithm was evaluated on a 13.2-kV-class hydro generator at Dae-chung Dam that has been operated for over 25 years. The proposed algorithm showed better performance in the evaluation than the conventional method.*
Keywords: Partial discharge, PD, Noise elimination, Stator winding, Wavelet denoising

1. **Introduction.** High-voltage generators are essential components of a reliable electric power generation system. They must operate continuously and so must be very reliable because a fault in a high-voltage generator could compromise the power supply. And given that continuous operation is critical, on-line diagnosis is the best preventative measure. Further, because such faults are largely caused by insulation breakdown in the stator winding, a common method of on-line diagnosis is partial discharge (PD) detection in the stator winding. PD detection is the most widely accomplished using a capacitive coupler. However, the signal from the coupler often contains a large noise component that prevents precise diagnosis. The consequences are frequent, and hence more expensive, maintenance and other unnecessary changes. Therefore, it is very important to eliminate noise from the on-line PD signals. Conventional noise elimination algorithms rely on a hardware filter and the fast Fourier transform (FFT), etc. However, these methods are not compatible with an aperiodic pattern of signals. The wavelet denoising algorithm, however, overcomes the problem by using shifting and scale changes on a mother wavelet. Yet the wavelet denoising algorithm also has a drawback – it does not eliminate white noise completely [2,3]. This paper presents a new noise elimination algorithm using the wavelet transform followed by a standard deviation threshold. Development of this algorithm was triggered by the need to remove white noise artifacts from the on-line PD signal. The proposed algorithm forms the basis for a newly developed PD monitor for high-voltage rotating machine. The proposed algorithm is capable of eliminating white noise artifacts associated with switchgears, sparks from slip rings and transformers, etc. The algorithm comprises