A digital dual-phase lock-in amplifier for MFL and ECT NDT applications

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ABSTRACT
In the electromagnetic methods of NDT, the separation of complex magnetic signals, i.e., Magnetic Flux Leakage (MFL) and Eddy Current (EC), is hard to be achieved. Therefore, the utilization of phase-sensitive detection technique of lock-in amplifier can be applied to overcome this problem. Furthermore, due to several disadvantageous, the digital lock-in amplifier is preferable compared to the analog lock-in amplifier. Also, a dual-phase lock in amplifier excels in term of overcoming the error caused by the phase shift circuit compared to the single-phase lock-in amplifier. In this study, a digital dual-phase lock-in amplifier is developed via NI-LabVIEW. A data acquisition card (NI-DAQ 6212, National Instruments, USA) is used for the data acquisition purpose. With the 16-bit ADC converter of the NI-DAQ 6212, the input range of the DAQ was set from −5 V to 5 V. Then, the frequency, phase and noise characteristics of the developed lock-in amplifier are studied. From the results, in terms the characteristics of frequency and phase, it can be said that the developed lock-in amplifier does fulfill its job in extracting the correct amplitude and phase. Meanwhile, in term of noise characteristics, the performance of the developed lock-in amplifier is still reliable with some margin of errors.

KEYWORDS
Lock-in amplifier; Dual-phase; NDT; MFL; ECT

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