A Rotor Fault Detection System Based on Nonlinear and Dynamic Response

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Electric motors are essential to modern-day life, safe operation of the electric motor is therefore vital to their operators. Studies on the fault of the electric motor, diagnosis accurately, and maintenance of all kinds of faults have high practical values, especially with the proliferation of electric vehicles and wind power. The winding rotor, in particular, is the core component of the motor, and its short-circuit fault is one of the primary modes of failure that seriously affects the performance of the motor. More importantly, the safety of the users is the biggest concern. Therefore, this research aims to develop a comprehensive electromagnetic induction-based inspection system that accurately diagnoses electric rotor faults and quality in production and maintenance environments. Accurate diagnosis of motor rotor faults and suppression of noise/interference will be achieved to the greatest extent in this research. The developed system begins with the excitation of the rotor using a time-vary magnetic field, which generates an electromagnetic response when there is rotor failure or quality issue. And in turn, the response is converted into an acoustic signal that would be processed for fault detection, as evidenced by the four key outcomes listed below, (1) Electromagnetic generator is constructed to excite the inter-turn of the rotor windings. (2) Electromagnetic probe amplifies the winding inter-turn fault by mechanical vibration. (3) The acoustic level sensor collects the probe’s rotor fault vibration signal. (4) EEMD method is used as auxiliary analysis in conjunction with a DSP chip to improve the qualify of the fault signals extraction.