

1.6.12. SIGNAL PROCESSING METHODS FOR MAGNETIC FLUX LEAKAGE TESTING BASED ON BISPECTRUM

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Magnetic flux leakage testing is widely used in ferromagnetic material on-line and in-service testing for its high efficiency, high speed, and ability of testing both outside and inside flaws. However, it is an unsolved problem of identifying types of flaws. A signal analysis method based on Higher Order Statistics (HOS) was introduced for processing magnet leakage testing signals in this paper. Firstly, it is validated that the background noises attribute to Gaussian distribution and the flaw signals attribute to Non-Gaussian distribution. Secondly, the analytical models of magnet leakage fields were separately built both for the quadrate slot and circular hole. Analysis for bispectrum diagonal slice of the discretized theoretical solutions demonstrated that the quadrate slot signal's characters of bispectrums were obviously distinguished from the through hole signals. It established the theoretical basic for identifying flaws in magnet leakage testing. In the last, Identification for crack and hole was realized by comparing the number of wave peaks of bispectrums for the signals obtained from in-service oil pipe testing system, and its correction proportion exceeds 70%. Identification for inside flaw and outside flaw was realized by comparing to the eigenvalue which is the ration of peak value to hypopeak value of bispectrums for the signals obtained from in-service tubing testing system, and its correction proportion exceeds 80%.