

# **Multi-parameter Integrating of MFL and ACFM detection system for In-line pipeline evaluation**

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Magnetic flux leakage (MFL) detection methods are widely used to detect pipeline defects. However, it is limited by lift-off and magnetic intensity. This paper proposes a new multi-parameter integrating sensor structure of merging alternating current field measurement (ACFM), eddy current testing (EC) as well as MFL to construct a multi-parameter detection system for different types of pipeline defects detection. In particular, permanent magnet is used to partially magnetize the axial pipeline to detect the circumferential defects while the strip magnet yoke excites the circumferential uniform alternating current field, and then recognizes the axial defect. The ACFM detection method is insensitive to lift-off and has the advantages in defect depth quantification, while eddy current has high sensitivity to the detection of small cracks. Meanwhile, the proposed detection method adopts magnetic sensor and differential coil arrays, which are integrated on a printed circuit board (PCB) to detect MFL, ACFM and EC signals, respectively. A lowpass filter and an amplitude amplifier are presented to optimize the magnetic sensor signals which are acquired by a data acquisition (DAQ) card. In addition, finite element simulations and experiments are carried out to verify the proposed sensor is effective and practical in pipeline defect detection and evaluation.