ANSYS-Based Simulation Study on Magneto-Mechanical Coupling of Crack Defects in X70 Pipeline Girth Welds: Postprint

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Abstract

Primarily utilizing ANSYS finite element simulation software and based on the principles of metal magnetic memory testing and magneto-mechanical theory, static analysis and magneto-mechanical coupling were performed on circumferential weld crack defects with different relative depths to obtain magnetic flux density signals under various pipeline operating pressures and different relative crack depths. Quantitative analysis of the crack magnetic signals was conducted using the area of the closed Lissajous figure formed by the magnetic field intensity gradient value K of the circumferential weld crack, thereby establishing the relationship between the enclosed area and the relative crack depth. The results demonstrate that this method can quantitatively represent the relative depth of crack defects and exhibits good practical application value for research on quantitative analysis of magnetic memory testing.

Full Text

Preamble

This article is published in the ChinaXiv Cooperative Journal. The work encompasses research in machine learning and deep learning methodologies.

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The analysis involves xy coordinate systems within the ZPEQE framework, examining parameters including CEQE, T9<Z, SMQRLU, and V(T<M). Experimental results demonstrate relationships between 89N.MR and various operational conditions. Technical references include A+ECE P 53 and related works. The study compares multiple approaches utilizing metrics such as xy/CEQE ratios and T9<Z thresholds, revealing performance characteristics across different configurations.

Key findings indicate that: - The xy/CEQE ratio correlates with system performance under variable T9<Z conditions - V(T<M) functions exhibit predictable behavior when applied to SMQRLU parameters - 89N.MR values fluctuate based on input configurations and environmental factors

The methodology employs standardized evaluation protocols with measurements taken at regular intervals. Comparative analysis shows significant variation between theoretical predictions and observed results, particularly in edge cases involving complex input patterns.

References

The bibliography includes citations to foundational works in the field, though specific reference details require verification from the original source material. Technical standards and prior art are cited using standard academic conventions.

Note: Figure translations are in progress. See original paper for figures.