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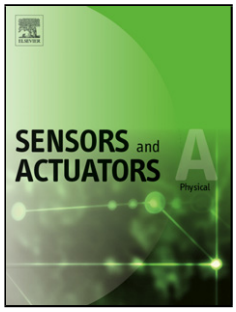

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PII: S0924-4247(16)30990-6
DOI: http://dx.doi.org/doi:10.1016/j.sna.2017.08.009
Reference: SNA 10263

To appear in: *Sensors and Actuators A*

Received date: 24-11-2016
Revised date: 2-3-2017
Accepted date: 3-8-2017

Please cite this article as: Yu Chang, Jingpin Jiao, Guanghai Li, Xiucheng Liu, Cunfu He, Bin Wu, Effects of excitation system on the performance of magnetic-flux-leakage-type non-destructive testing, Sensors and Actuators: A Physicalhttp://dx.doi.org/10.1016/j.sna.2017.08.009

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ACCEPTED MANUSCRIPT

Effects of excitation system on the performance of magnetic-flux-leakage-type non-destructive testing

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Highlights

- The effects of the structural design and parameters of the excitation system on performance of MFL testing was investigated using parameterized FE;
- A parameter optimization method, combining parameterized FE with genetic algorithm, was proposed to optimize the dimensions of the yoke;
- A MFL sensor with a preferred structural design and preferred parameters of the excitation system was proposed;
- The superior performance of the MFL sensor with the preferred excitation system was validated experimentally.

Abstract: The effects of excitation system on the performance of magnetic flux leakage (MFL)-type non-destructive testing were investigated. The investigation employed parameterized finite element analysis of the MFL testing of ferromagnetic samples to reveal the effects of the structural design and parameters of the excitation system, including the geometry and dimensions of the yoke, lengths and positions of coils and thickness of the shielding layer. Moreover, a parameter optimization method, combining parameterized finite element analysis with a genetic algorithm, was proposed to optimize the dimensions of the yoke and thus obtain maximum magnetic flux leakage. Simulation and optimization results were used to propose an MFL sensor with a preferred structural design and preferred parameters of the excitation system. Comparative experiments were conducted to validate the numerical simulation results. The experimental results agreed well with the results of numerical simulation, and the superior performance of the MFL sensor with the preferred excitation system was validated.

Keywords Non-destructive testing; Magnetic flux leakage; Preferred excitation system; Parameterized finite element analysis; Genetic algorithm

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