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An analysis in metal barcode label design for reference

Key words: Metal barcode label, Signal detection, AC field measurement, Internet of things

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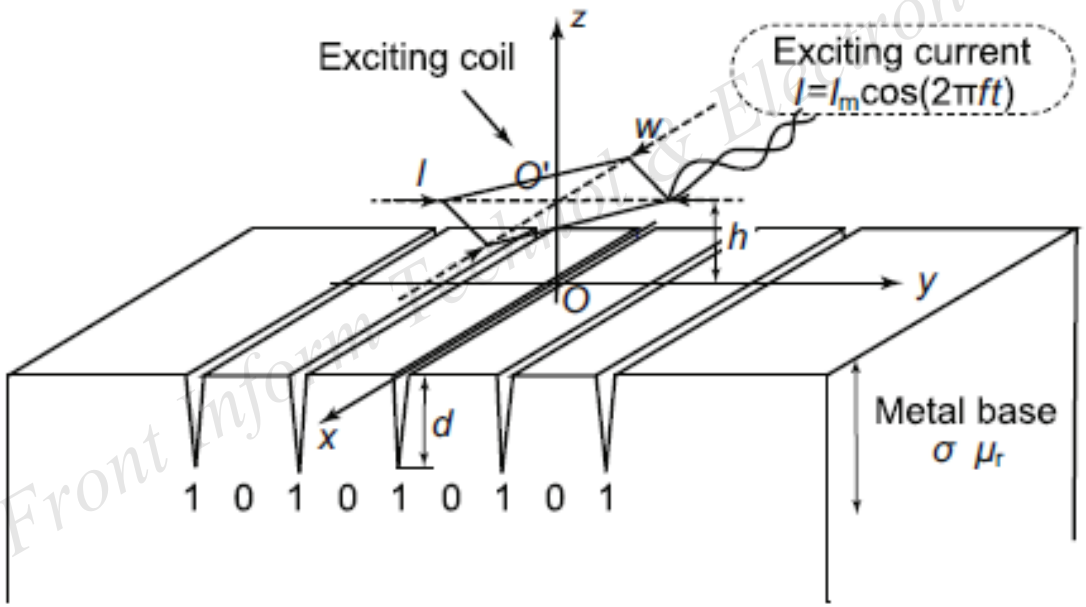
Introduction

- Metal barcode labels (MBLs) have been presented in this work to meet the requirements of the information perception for Internet of things (IoT) in harsh environments such as industry and military.

- Reading techniques based on image recognition are hypersensitive to stain.

- The references in designing MBLs have been given in this work.

Metal barcode label: schematic diagram



Measurement results (1)

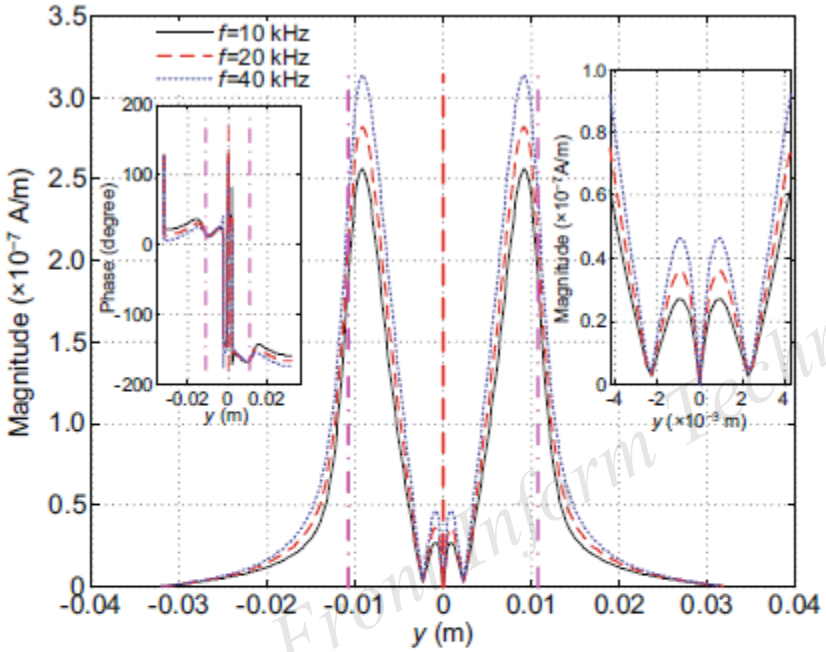


Fig. 4 Magnitude of H_y in identifying MBLs containing a single notch under different operating frequencies. The left subplot shows the phase of H_y, and the right subplot shows the detailed magnitude of H_y at the position of the notch. The position of the notch is marked with vertical dashed line, and the position of the exciting coil is marked with vertical dash-dotted lines

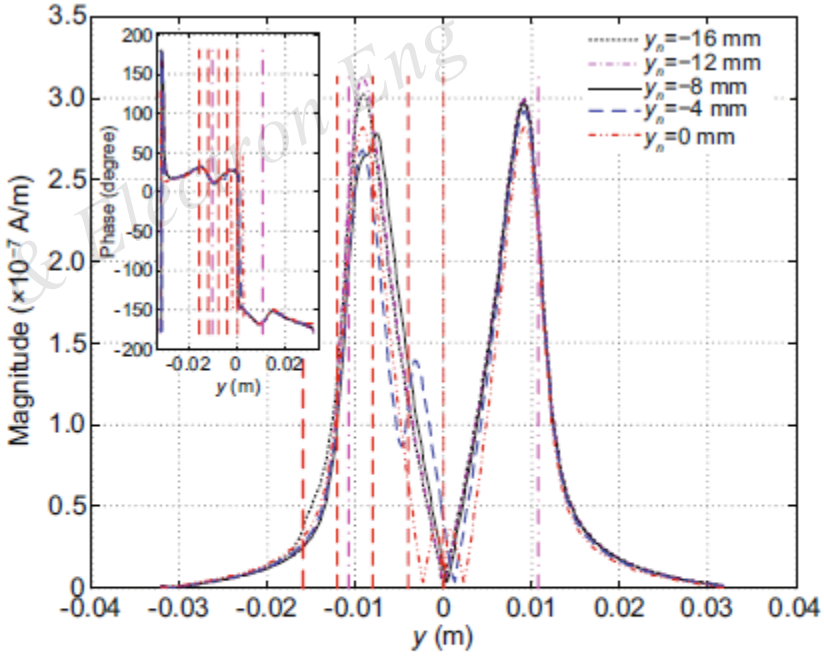


Fig. 5 Magnitude of H_y in identifying MBLs containing a single notch at different positions. The inset shows the phase of H_y. The position of the notch is marked with vertical dashed line, and the position of the exciting coil is marked with vertical dash-dotted lines

Measurement results (2)

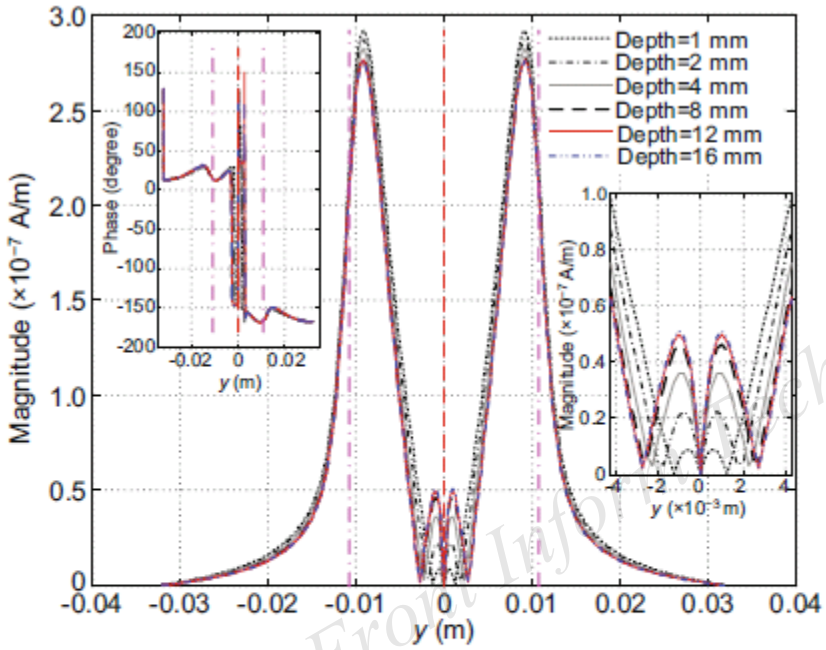


Fig. 6 Magnitude of H_y in identifying MBLs containing a single notch with different depths. The left inset shows the phase of H_y. The right inset shows the detailed magnitude of H_y at the position of the notch. The position of the notch is marked with vertical dashed line, and the position of the exciting coil is marked with vertical dash-dotted lines

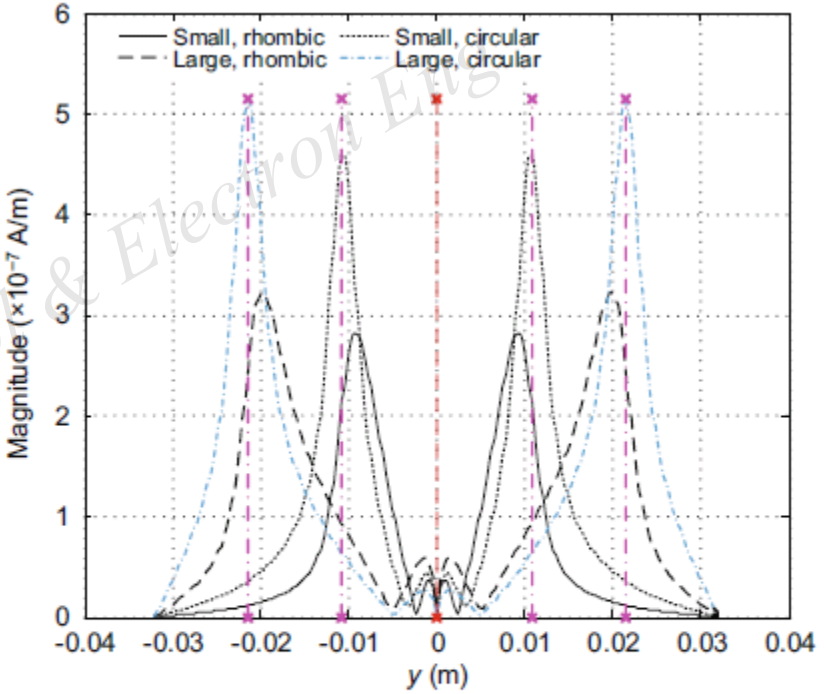


Fig. 7 Magnitude of H_y in identifying MBLs containing a single notch under exciting inducers with different shapes and sizes. The position of the notch is marked with vertical dashed line, and the position of the exciting coil is marked with vertical dash-dotted lines

Measurement results (3)

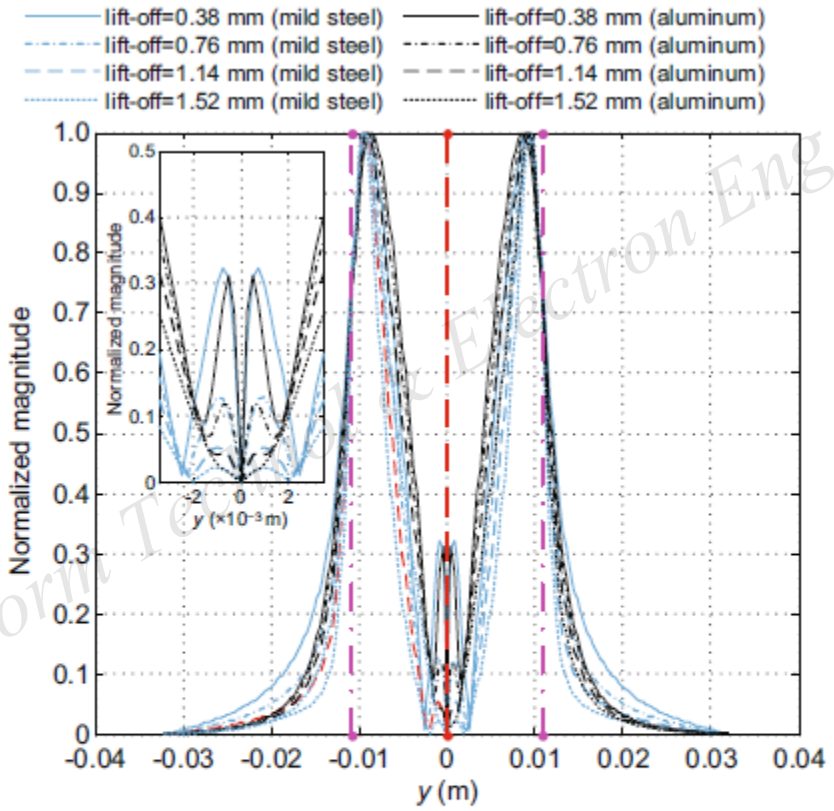


Fig. 8 Normalized magnitude of H_y in identifying MBLs containing a single notch with different lift-offs. The inset shows the detailed normalized magnitude of H_y at the position of the notch. The position of the notch is marked with vertical dashed line, and the position of the exciting coil is marked with vertical dash-dotted lines

Conclusions

- The magnitude detection should be employed in positioning notches with ACFM technique;
- The metal substrate should be made of metal materials with large relative permeability;
- The notches should be placed in the center region;
- The depth of notches should be in the range of 4–8 mm;
- A rhombic exciting coil could improve the identification of notches compared with a circular one;
- A small exciting coil could improve the identification of notches compared with a large one;
- A large exciting coil could enlarge the region in which a notch can be detected compared with a small one;
- The anti-jamming ability of ACFM detection can be improved by increasing the operation frequency;
- The pick-up coil should be placed close to the MBL as much as possible.