DD01

Magnetic Sensor for the Defect Detection of Steam Generator Tube with Outside Ferrite Sludge

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Steam generator tube in nuclear power plant is a boundary between primary side and secondary side, whose integrity is one of the most critical factors to nuclear safety. Eddy current inspection techniques are currently among the most widespread techniques for the rapid inspection of steam generator tube in the nuclear power industry, because Inconel600 alloy which is employed in steam generator tube has magnetic properties of feebly magnetic material having relative permeability about 1. In case of the small magnetic phase having higher permeability in steam generator tube or magnetic sludge partly produced outside of the steam generator can cause spurious eddy current test results [2]. They bring out difficulties for the safety maintenance of the steam generator tubes in nuclear power plant. We developed a new type of sensor employing magnetic permeability variation measurement for detecting magnetic phase, it could be also apply to normal defects[3]. In this work, we applied the developed sensor to detect defects which is located outside of the steam generator tube has magnetic sludge.

Fig. 1. Photography of the developed sensor system.

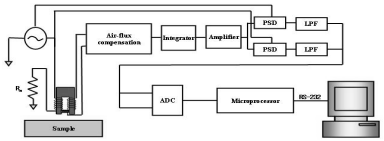

Fig. 2. Schematic diagram of measuring system.

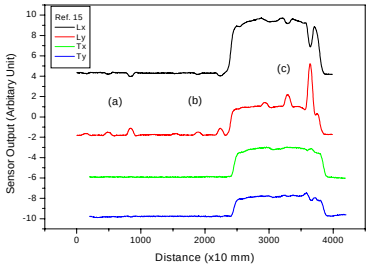

Fig. 3. Signals from the reference material; (a) signals of defects located inside of tube, (b) signals of defects located outside of tube, and (c) signals of defects with outside has magnetic sludge.

REFERENCES

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DD02

Novel Mutual Inductance Calculation of the Magnetically Coupled Coils: Thin Wall Solenoid-circular Coil with Rectangular Cross Section in Air

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The magnetically coupled coils are important in magnetically controllable devices and sensors, in modern medicine and telemetric systems applied in biomedical engineering (long-term implantable devices such as pacemakers, cochlear implants, defibrillators, instrumented orthopedic implants), in conventional medical MRI systems, tokamaks, superconducting coils. In all these applications it is necessary to calculate or measure the mutual inductance of magnetically coupled coils. The purpose of this paper is to present an elliptic integral-based solution for two coaxial coils including the thin wall solenoid and the circular coil with the rectangular cross section. This calculation leads to very accurate and new semi-analytical formulas expressed over the complete elliptical integrals of the first and second kind, Heuman's Lambda function and one member that has to be solved numerically using a numerical integration. Computed mutual-inductance values obtained by the proposed approach and previously published data are in excellent agreement. The presented method is suitable either for microcoils or large coils.