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Evaluation of Eddy-current Probe Signal Due to Cracks in Metallic Parts of a Fast Reactors

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Eddy current testing to evaluate the condition of metallic parts in a fast reactor under standby conditions is challenging due to the presence of conductive coolant, for example liquid sodium at 250 °C. The eddy current probe should be sensitive enough to capture small signal changes and hence an advanced inspection systems is needed. We have developed new hardware and improved numerical model to predict the eddy current probe signal due to crack in metallic fast reactor parts by using volume integral equation method. The analytical expressions are derived for the quasi-static time-harmonic electromagnetic fields of a circular eddy current coil to take account of the effect of conductive coolant. Naturally, the method of moment is used to approximate the integral equation and obtain the discrete approximation of the field in the crack domain. The simple and accurate analytical method for dealing with the hyper-singularity element evaluation is also provided. The probe impedance variation has been computed for narrow cracks. This model can be used to refine the eddy current probe design and predict the probe signal for comparison with experiment.

References:

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