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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