Detecting a Crack - A Problem in N.D.T. (T.E.A.M. Problem 8)

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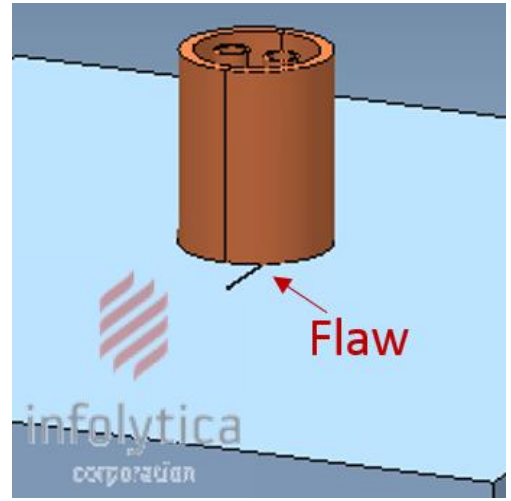
In this example, Simcenter MAGNET simulates an eddy current NDT (non-destructive testing) problem: a stainless steel block containing a crack with a probe (consisting of one inducing solenoid and two receptive solenoids) moving across its surface.

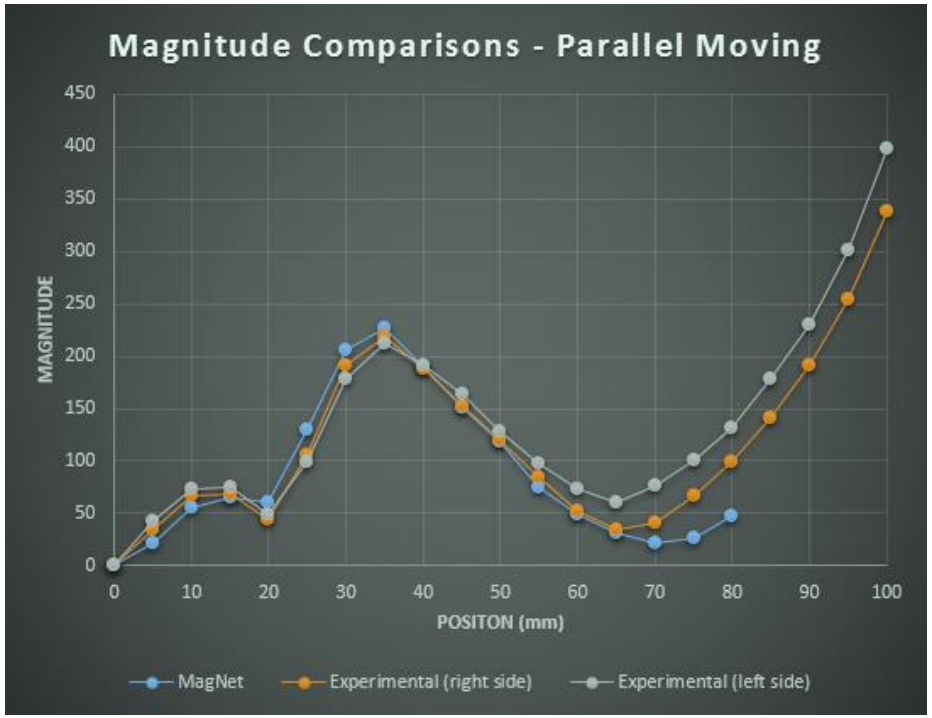
The objective is to detect the crack by measuring the difference of magnetic fluxes through the two solenoids.

Using Simcenter MAGNET's Time Harmonic solver, the induced eddy currents are accurately simulated and compared with measured experimental results.

The following is based on the Testing Electromagnetic Analysis Methods (T.E.A.M.) problem #8: Coil Above a Crack: A Problem in Non-Destructive Testing. The benchmark can be found on the International Compumag Society's website.

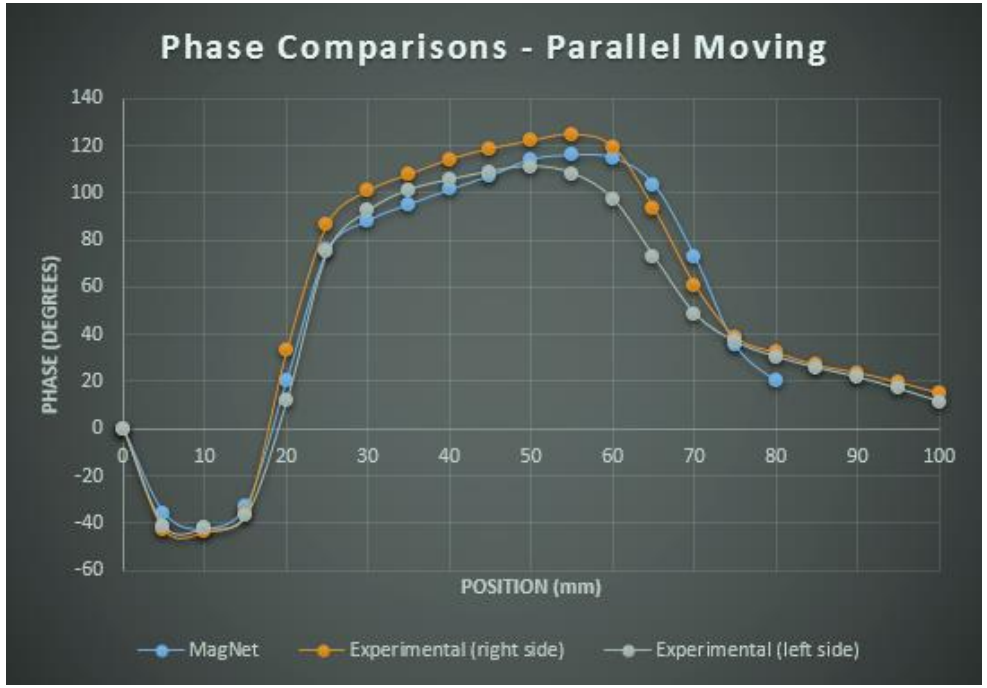


MAGNETIC FLUX - MOVING PARALLEL TO THE CRACK



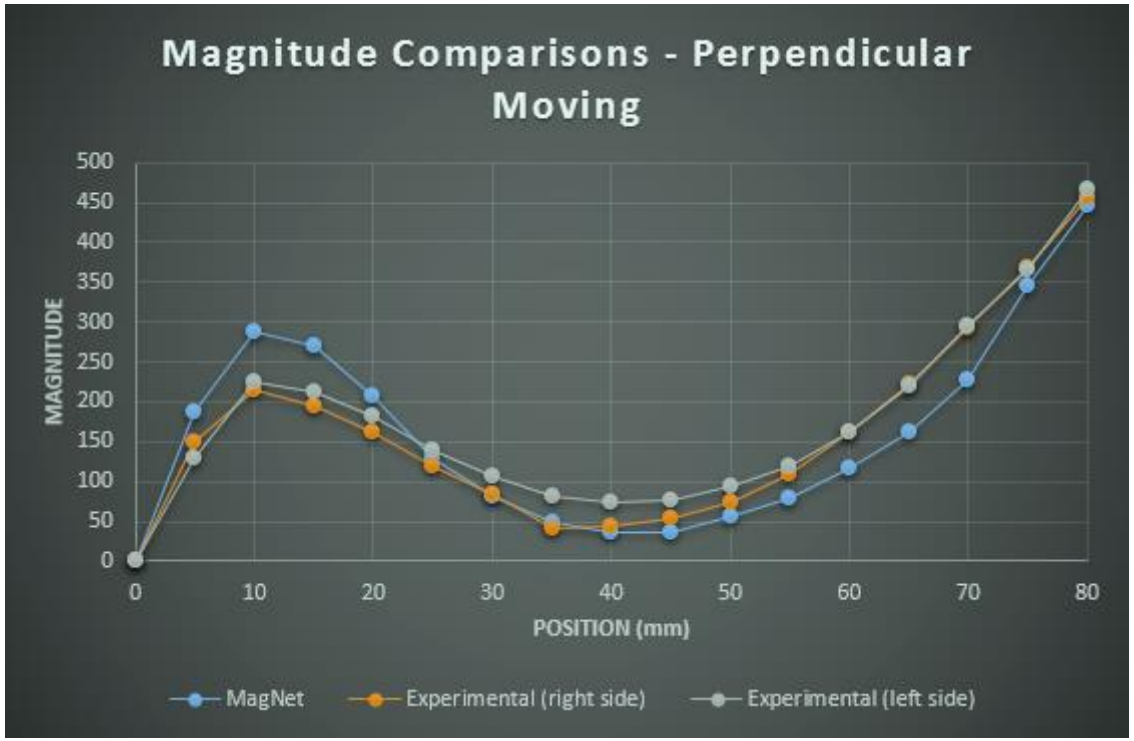
This graph displays the magnitude of the differential magnetic flux of the two receptive solenoids when the probe is moved away from the center of the crack in a direction parallel to the crack. The experimental results were given in a dimensionless form; hence, the Simcenter MAGNET result has been scaled to give the best fit.

PHASE COMPARISONS - PARALLEL MOVING



This graph displays the phase of the differential magnetic flux of the two receptive solenoids when the probe is moved away from the center of the crack in a direction parallel to the crack. Since the experimental results were given without a phase reference, the Simcenter MAGNET result has been shifted to obtain the best fit.

MAGNITUDE COMPARISONS - PERPENDICULAR MOVING



This graph again shows the comparison of the magnitude of the differential magnetic flux; however, in this case the probe is moving away from the flaw in a direction perpendicular to the crack instead of parallel to it.

PHASE COMPARISONS - PERPENDICULAR MOVING

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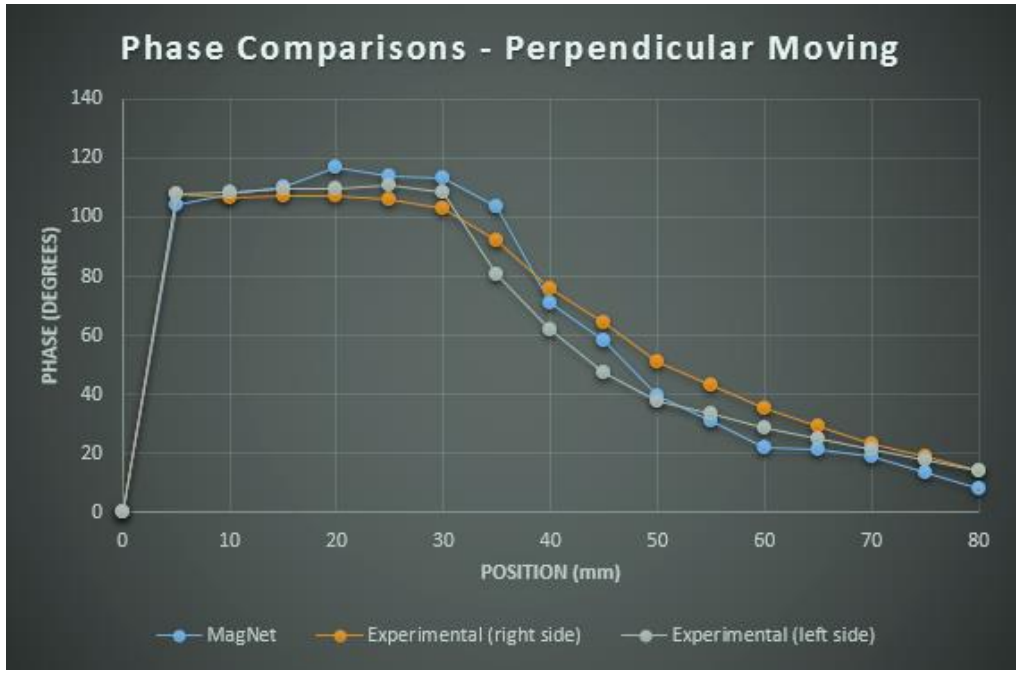

This graph shows the comparison of the phase of the differential magnetic flux when the probe is moved in a direction perpendicular to the crack.

PARALLEL MOTION

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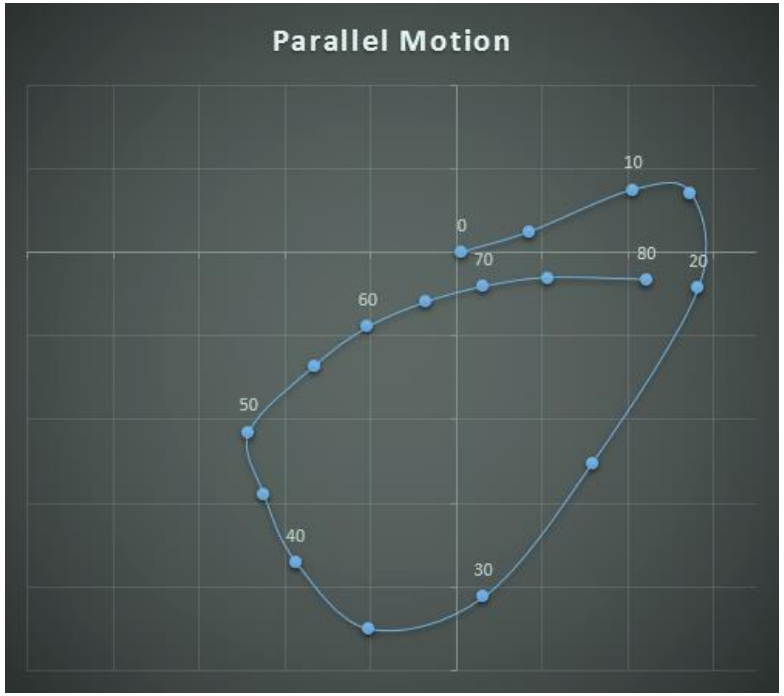

This graph shows the differential magnetic flux of the probe when moved parallel to the flaw. The data is normalized so that it matches the graph in the original TEAM 8 benchmark paper.

PERPENDICULAR MOTION

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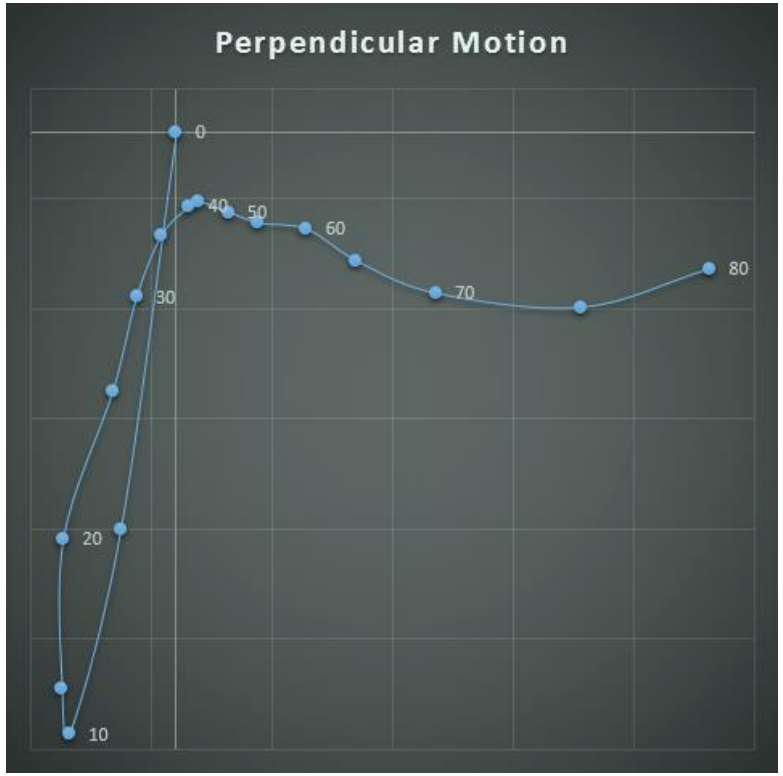

This graph shows the differential magnetic flux of the probe when moved perpendicular to the flaw. The data is normalized so that it matches the graph in the original TEAM 8 benchmark paper.

360 spin of an Array Plot