Forward solver for deep earth exploration and induction logging using custom built Edge-Element FEM technique

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Electromagnetic inspection and imaging methods can be used in deep earth exploration and induction logging. Due to the complexity of the surrounding media, the forward problem is challenging.

In this study, an EM solver using finite edge-element methods was developed for the simulation of the eddy current distribution within deep earth environments. The custom built FEM solver in this study uses a weakly-coupling assumption and was shown to be more efficient than conventional solvers, in particular for a sensor scanning mode.

The solver can also compute material equivalent conductivity, which provides an indication of material property on the surrounding media.

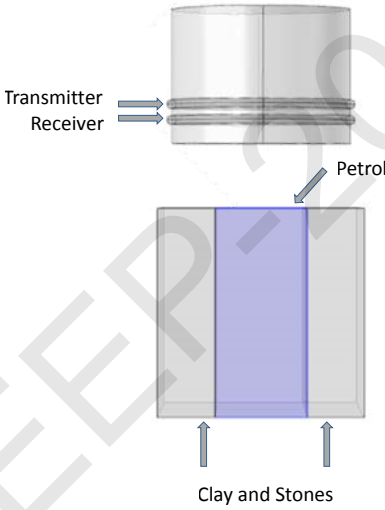

Figure1. Sensor setup and location with respect to detected media

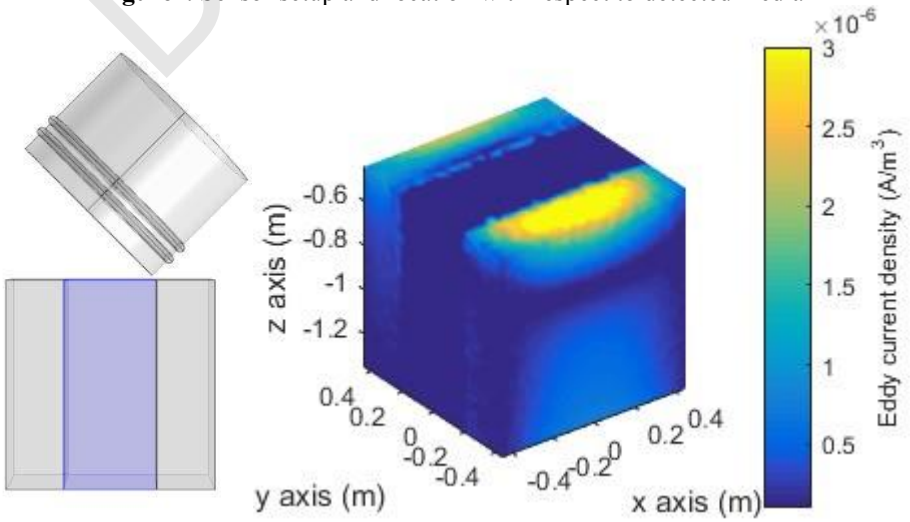

Figure 2. Eddy current distribution when sensor is rotated at -45°

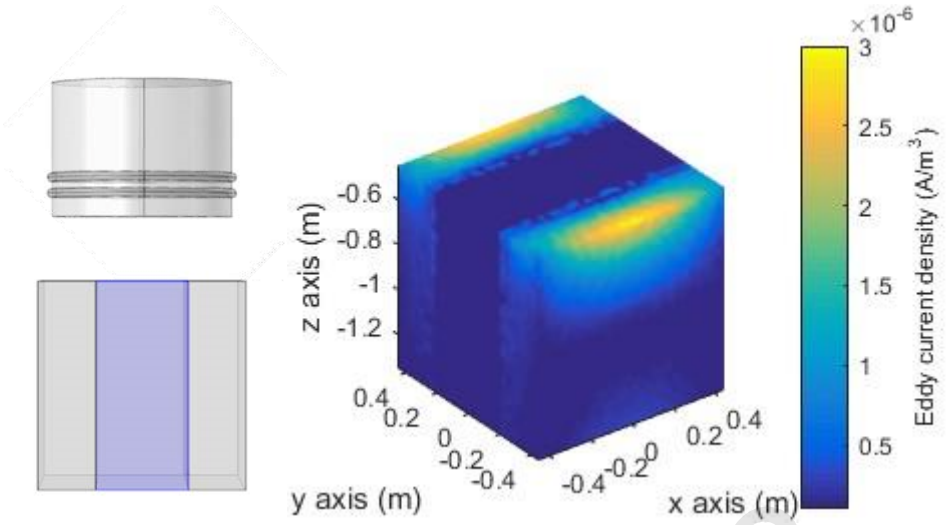

Figure 3. Eddy current distribution when sensor is rotated at 0º

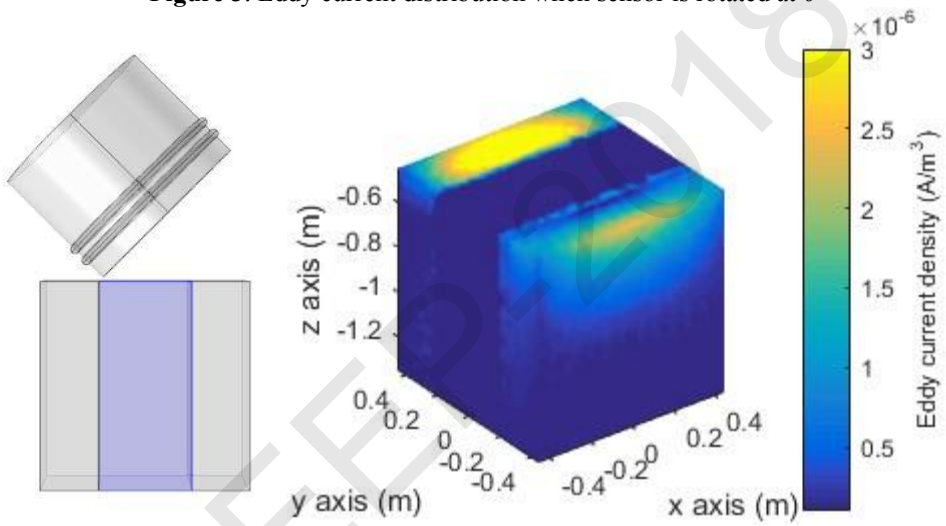

Figure 4. Eddy current distribution when sensor is rotated at 45º

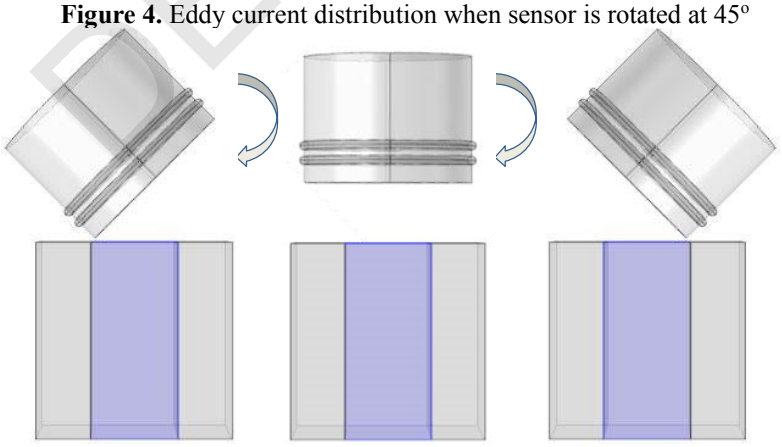

Figure 5. Sensor rotation process (from -45º to 45º)

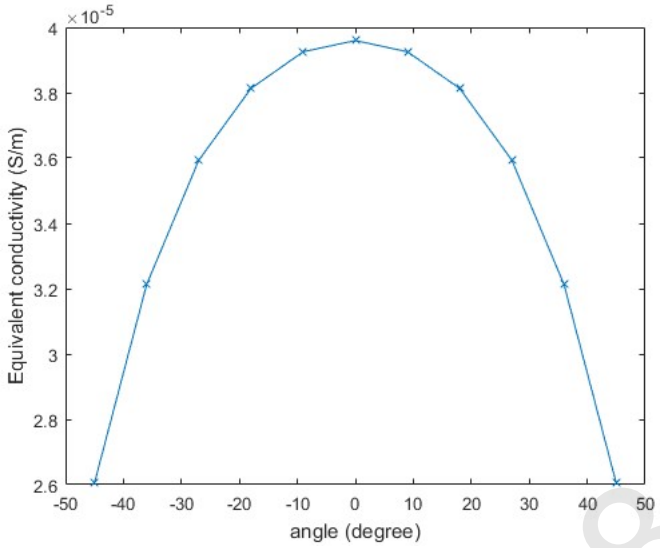

Figure 6. Computed equivalent conductivities on the sensor rotation samples (from -45º to 45º)

References

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