Eddy Current Measurement and Simulation in Dielectric Fluids for Transcranial Magnetic Simulation Calibration

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Eddy are electric current generated through conductors by a changing magnetic field in the conductor. In many important bio-electromagnetic problem settings, eddy-current simulations are required, as in Transcranial Magnetic Stimulation (TMS) the coil conducts eddy current in order to excite patient neurons. TMS is a noninvasive method to cause depolarization in the neurons of the brain. TMS uses electromagnetic induction to induce electric currents called eddy's current. A current passing through eight figure coil generates a magnetic field perpendicular to the current direction in the coil. A rapid change of this magnetic field causes in turn a transient electric field. The magnetic field penetrates the patient brain focused at the limbic system (controls emotional and behavioral patterns), eddy current induced in the brain perpendicular to the magnetic, in order to excite the neurons with the required charge to become active.

Our group at Wilkes University is developing the TMS solver that able to simulate the entire brain and create the map of eddy current inside the brain tissues. In order to validate the simulation results, we are developing a measurement setup to measure the eddy current inside some known reference objects and compare them with simulation results and calculate a coefficient factor that will help simulated values much closer to actual values.The accurate eddy current measurement will help in inventing simulation system that will simulate the TMS process in order to provide visual feedback during the treatment, which currently does not exist in the TMS procedure. The process of accurately determining the eddy current intensity strongly depends on the calibration. In this talk we will explain the procedure of calculating the calibration coefficient and appropriate known fluids materials.