New Way of Generating Transcranial Magnetic Stimulation

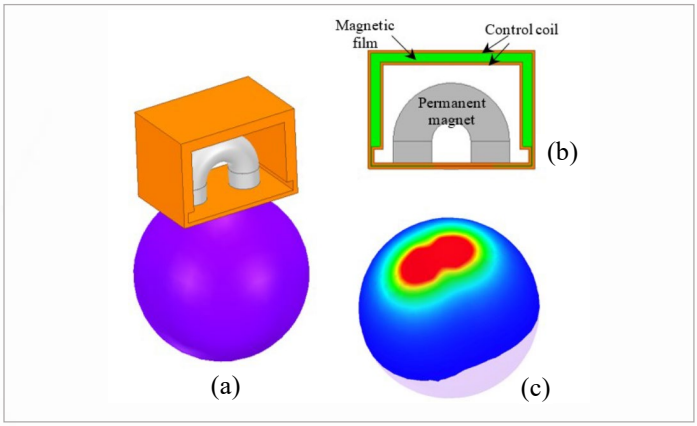
VTIP 22-041: “New Approach on Generating Electromagnetic Waves for Transcranial Magnetic Stimulation”

THE CHALLENGE

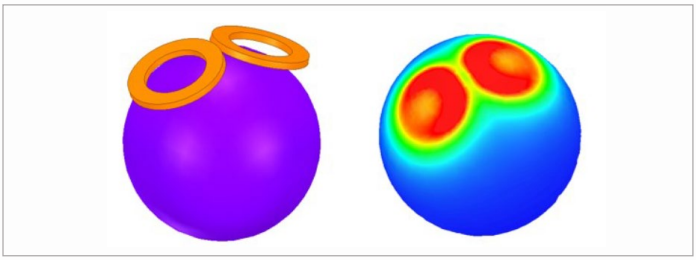
Transcranial Magnetic Stimulation (TMS) is a noninvasive procedure that uses magnetic fields to stimulate nerve cells to study brain function and treat neurological/psychiatric disorders such as depression and traumatic brain injury. Methods of generating TMS via coils are limited in their ability to target desired neural cells populations due to depth-focality tradeoff and their reliance on high-energy pulse sources which raise safety concerns.

OUR SOLUTION

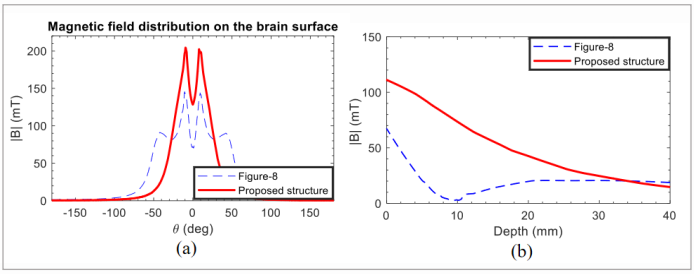
The Manteghi lab at Virginia Tech has developed a new method of generating TMS, utilizing the modulated magnetic field of a permanent magnet, equivalent to a lossless electromagnet. The magnetic reluctance of the medium surrounding the permanent magnet is modulated to alter magnetic flux intensity and direction, resulting in a time-variant field. Stimulation results show that the focality and penetration depth is improved while using significantly less power than conventional TMS devices which use figure-8 coils.



(a) 3D view of the proposed system in the presence of the spherical head model, (b) cross-section from the proposed system, (c) the induced magnetic field distribution on the brain (Open Mode).



Simulation model of the figure-8 and its induced magnetic field distribution on the brain.



Comparison of magnetic field variation (a) on the circle around the brain surface; i.e., focality, (b) inside the brain, in a line passing through the middle of the structure and center of the brain; i.e., depth.

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