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Design of Advanced Coils for Cerebellar Transcranial Magnetic Stimulation

V. Salas Moreno*(1), J. A. Vílchez Membrilla(1), F. J. García Pacheco (2), A. P. Valerga Puerta (3), M. Fernández Pantoja (4) , V. Souza (5) and C. Cobos Sánchez(1)
(1) Department of Electronics, University of Cadiz, Cádiz, Spain
(2) Department of Mathematics, University of Cadiz, Cádiz, Spain
(3) Department of Mechanic Engineering and Industrial Design, University of Cadiz, Cádiz, Spain
(4) Department of Electromagnetism, University of Granada, Granada, Spain
(5) Department of Neuroscience and Biomedical Engineering, Aalto University, Espoo, Findland

1 Extended Abstract

In recent years, the application of Transcarial Magnetic Stimulation (TMS) to the cerebellum has become a promising option to study brain motor behaviour, as well as, cognitive and perceptual functions [1]. However, there are not specific systems for cerebellar TMS and the current research is based on conventional coils, such as butterfly coil or double cone coil, that produce shallow or non-focal stimulation [2].

Here we propose novel specific coils for cerebellar TMS designed by using a continuous current distribution Inverse Boundary Element Method [4]. Different TMS coils based on geometries that readily adapted to the human head were produced to stimulate a specific region of the cerebellum. The center of each coil was located 3 cm left from the inion point approximately, Fig. 1a. The wire pattern of a minimum power dissipation coil serially connected is depicted in Fig. 1b, which when energized induces the electric field shown in Fig. 1c.

Coil in Fig. 1 was simulated in a realistic human brain model, and the following metrics were obtained [3]: minimum suprathreshold volume $V_{1/2} = 14.75$ cm^3 and $V_{1/2} = 11.10$ cm^3 for cerebellum and occipital lobe respectively, and maximum depth stimulation was $d_{1/2} = 1.58$ cm. The presented framework for creating dedicated optimal TMS coils allows novel geometries that bring the coil closer to the cerebellum target region, thus improving the stimulation efficiency.

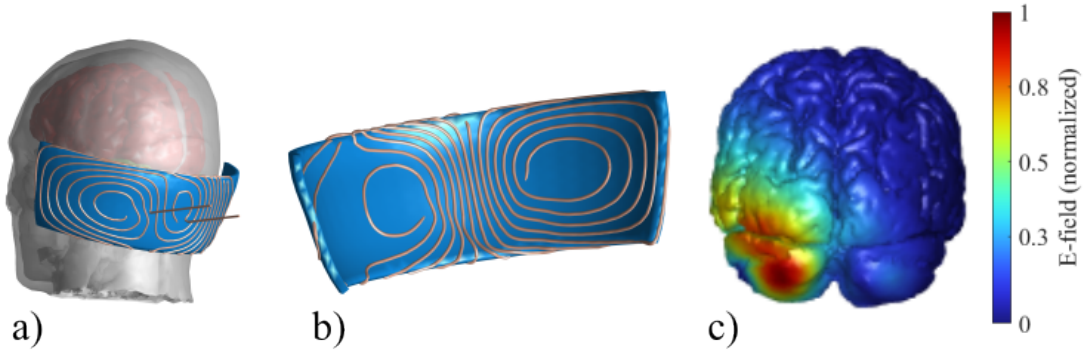

Figure 1. a) Coil location for left hemisphere cerebellar stimulation. b) Minimum power dissipation TMS coil. c) Normalized induced electric field produced by the coil on the cerebellum and cerebrum.

References

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