# ABSTRACT

Transcranial magnetic stimulation is a non-invasive, safe, painless out-patient treatment for major depressive disorder. In TMS, time varying magnetic field is used to induce electric field, in the region of interest, to stimulate the neurons. Coil design is an important aspect of TMS, as coils are used to navigate the magnetic field in the desired location. The work presented in this dissertation is regarding the use of the coil design development for the application of transcranial magnetic simulation. Two TMS coils namely the Triple Halo Coil and the Quadruple Butterfly Coil were presented, with one aiming for deep brain stimulation and other one for precise stimulation. The magnetic field due to the Triple Halo Coil is 7 times more than circular coil at 10 cm below the head. It can stimulate deep brain regions which are affected in disorders such as Parkinson’s disease and PTSD. The Quadruple Butterfly Coil has reduced volume of stimulation by around 10% at the vertex and dorsolateral prefrontal cortex when compared with the Figure-8 coil. Fifty heterogeneous MRI derived head models were used for the analysis of the induced electric field due to the Quadruple Butterfly Coil and the results were compared with the Figure-8 coil. For both the coils, first computer modelling was done on heterogeneous head models, using a finite element tool and testing using a prototype built by Jali Medicals with the help of an axial Hall probe and a gaussmeter. Furthermore, seven different coils for small animals were presented in this dissertation. These coils had varying electric field with the Slinky coil having the minimum area of stimulation and lowest electric field below 10 mm of the head, while the Animal Halo Coil had maximum area of stimulation and highest electric field at 1 mm below the head. Animal coils are important as animal testing reduces the cost and expedites the research time.