

# Department of Electrical and Computer Engineering



TEXAS TECH UNIVERSITY

Edward E. Whitacre Jr.  
College of Engineering™

## Spring 2024 Seminar Series

**Seminar Title: *Transcranial Magnetic Stimulation: A non-invasive neuromodulation technique for altering neuronal networks in the brain***

**Time:** 2:00-2:50 PM, Friday, Feb 2, 2024

**Location:** Holden Hall 150

### **Speaker:**

**Ravi L. Hadimani**

Virginia Commonwealth University

### **Abstract:**

Transcranial Magnetic Stimulation (TMS) can tune brain functions non-invasively, safely, and effectively without the need for surgery or drugs. Thus, it can enable the treatment of several debilitating neurological and psychiatric disorders and enhance cognitive capabilities. My lab has designed and fabricated an anatomically accurate human brain phantom that can be used to test the feasibility and safety of several TMS protocols. We have investigated a feasibility study of combined TMS and DBS using brain phantom in collaboration with the VCU Department of Neurosurgery. We have also designed and fabricated novel focal stimulation coils based on novel soft ferromagnetic materials that can stimulate only a local region of the primary motor cortex. We are currently working to experimentally verify the results from coil design in rats in collaboration with the Dept. of Neurology at VCU. We are also working to *establish an accurate mechanism underlying TMS by investigating the neuronal firing patterns in several brain regions induced by cortical stimulation and by establishing the role of individual nuclei in affecting other nuclei of the motor circuitry*. My team has also designed a TMS coil configuration that can stimulate multiple sites simultaneously and vary sites of stimulation without moving the coils physically. These new TMS techniques will enable the future development of effective TMS protocols for the diagnosis and treatment of several neurological and psychiatric disorders.

### **Speaker Bio:**

Dr. Hadimani is an Associate Professor and the Director of the Biomagnetics Laboratory at the Department of Mechanical and Nuclear Engineering of Virginia Commonwealth University. He is currently on sabbatical as a **Visiting Associate Professor at Harvard Medical School, Harvard** University. He has founded the IEEE Joint Magnetics and Engineering in Medicine and Biology Society's Richmond Chapter, and he is the current vice chair of the chapter. He is an Associate Editor of the journals, *Frontiers of Neuroscience* and *American Institute of Physics (AIP) Advances*. He is a member of US National Academy of Inventors. Dr. Hadimani's research focuses on biomagnetic materials and devices for biomedical applications, magnetocaloric heating/cooling, and energy harvesting. He has developed a first-of-a-kind anatomically accurate brain phantom for validating neuromodulation procedures that are commercialized through the university spin-off company RAM Phantoms LLC. Dr. Hadimani has received several international awards, including the UK Energy Innovation Award and the International Young Scientist Fellowship from the National Natural Science Foundation of China (NSFC). He also received the Engineer of the Year award from the Richmond Joint Engineers' Council in 2021. He has authored more than 110 peer-reviewed original research journal papers, more than 225 international conference papers, 15 current and pending patents, several invited trade magazine articles, a book, and 3 book chapters to date. Dr. Hadimani has a 'first class' honors degree in Mechanical Engineering from Kuvempu University, India, an MS in Mechatronics from the University of Newcastle, UK, and a Ph.D. in Electrical Engineering from Cardiff University, UK. He has served as a Project Scientist at the Institute of Materials Research and Innovation of the University of Bolton, UK. He was an Adjunct Assistant Professor and Associate Scientist at Iowa State University and was also an Associate at Ames Laboratory, US Dept. of Energy.