

IEEE Miami Section Invited Seminar Announcement

“Gradient Drivers for MRI Scanners: Advancing Power Electronics for Medical Instruments”

Speaker: Juan A. Sabate, Ph.D.

Date: 20 April, 2022

Lecture: 12:00 PM

Zoom: <https://fiu.zoom.us/j/98364582724>

Meeting ID: 983 64582 724, **Passcode:** YznTR7



Abstract:

The improvements in MRI as a diagnostic tool in terms of image quality, speed and clinical use have required increased capabilities and performance of the gradient amplifier. In addition, extremely high fidelity for reproducing the current command from the central system is very critical for imaging quality. Therefore, high power and high bandwidth gradient driver is needed for high performance MRI system. The driver output are arbitrary bidirectional currents that can be pulsating between zero and full power and must be reproduced with errors on the ppm range. Gradient Driver is one of the key components in a magnetic resonance imaging (MRI) scanner. The driver is responsible to create gradient fields by supplying the gradient coil with large current (>1000A) and high voltage (>2000V) to achieve strong gradient field and fast slew rate. The gradient driver consists of three switching power amplifiers (inverters), multiple power supplies and high-performance digital control: Switched amplifiers are implemented with cascaded H-bridges to have high ripple frequencies (>125kHz) for the required bandwidth at power levels needed. High-performance modular solution with SiC devices enables solutions with only two bridges and 99% efficiency. The accuracy for the currents supplied to the gradient coils requires regulated voltages provided to the inverter with reduced voltage change (<10%). The power supplies must be designed for peak power. Capacitors for energy storage in the system limit voltage sag and peak power draw from the facility power utilities., The presentation will provide a description of the electronics technology and technical implementation of the amplifiers currently used on the high-performance MRI systems.

Speaker's Bio

Since joining GE, Dr. Sabate has led multidisciplinary teams of scientists and engineers to develop power supplies and high-power switching amplifiers for energy and medical applications. He has also contributed to developing new portfolios for GE Energy and consulting with GE Aviation Systems to introduce SiC devices for power conversion. He worked for Philips Electronics Research in Briarcliff Manor, New York, from 1997 to 2000. From 1994 to 1997, He worked for Hewlett-Packard in their R&D center in Barcelona (Spain). He was a lecturer and Adjunct Professor in the Ramon Llull University (Barcelona, Spain) from 1994 to 1997. Since 2000, he has been at the GE Research, where he is a Senior Principal Engineer. Dr. Sabate has 40 issued U.S. patents. He has authored more than 70 conference and transactions papers and has presented five invited tutorials at the International Society for Magnetic Resonance (2010, 2011, 2012, 2016 and 2018), at the International Conference on Silicon Carbide and Related Materials (ICSCRM-2017), and at IEEE APEC 2019 about SiC power electronics applications. Dr. Sabate received his Ph.D. ('94) and M.S. ('88) degrees in Electrical Engineering from Virginia Tech.

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