Stanford

Juan Rivas-Davila

Assistant Professor of Electrical Engineering

Bio

BIO

Professor Rivas came to Stanford as an assistant professor in January 2014. He was an assistant professor in Electrical Engineering at the University of Michigan. Before becoming a faculty member in 2011, he worked for the General Electric Global Research Center developing power electronics for medical imaging and aviation systems. He received the B.Sc. degree in electrical engineering from the Monterrey Institute of Technology (Mexico) in 1998. He obtained his masters (2003) and doctoral degree (2006) at the Massachusetts Institute of Technology. His research interests are in power electronics, RF power amplifiers, resonant converters, soft switching topologies and design of power converters for operation in harsh environments.

ACADEMIC APPOINTMENTS

- Assistant Professor, Electrical Engineering

HONORS AND AWARDS

- Faculty Early Career Development (CAREER) Program", National Science Foundation (2013)
- Transactions Paper Award: "Resistance Compression Networks for Radio-Frequency Power conversion", IEEE Power Electronics Society (2007)
- 2nd Prize Award: High Frequency Resonant SEPIC Converter With Wide Input and Output Voltage Ranges", IEEE Power Electronics Society (2012)

PROFESSIONAL EDUCATION

- B.A., ITESM, Mexico City Campus , Electrical and Communications Engineering (1998)
- S.M., Massachusetts Institute of Technology , Output Power Increase at Idle Speed in Alternators (2003)
- Sc.D., Massachusetts Institute of Technology , Radio Frequency dc-dc Power Conversion (2006)

PATENTS

- Satish Prabhakaran, John Stanley Glaser, Ljubisa Dragoljub Stevanovic, Juan Manuel Rivas Davila. "United States Patent US 8567046 B2 Methods for making magnetic components", General Electric Company, Oct 29, 2013
- Rixin Lai, Luis Jose Garces, Juan Antonio Sabate, Juan Manuel Rivas Davila, Song Chi, Wesley Michael Skeffington,. "United States Patent US 8502539 B2 Gradient amplifier system", General Electric Company, Jul 31, 2013
- Mehmet Arik, Tunc Icoz, Juan Manuel Rivas Davila, Charles Erklin Seeley, Yogen Vishwas Utturkar, Stanton Earl Weaver, Jr.. "United States Patent US 8496049 B2 Heat sinks with distributed and integrated jet cooling", General Electric Company, Jul 30, 2013
- John Stanley Glaser, Juan Manuel Rivas Davila. "United States Patent US 7924580 B2 Switching inverters and converters for power conversion", General Electric Company, Apr 12, 2011
- David J. Perreault, Juan M. Rivas, Anthony D. Sagneri, Olivia Leitermann, Yehui Han, Robert C. N. Pilawa-Podgurski,. "United States Patent 7,889,519 B2 Methods and apparatus for a resonant converter", Massachusetts Institute Of Technology, Feb 15, 2011
- David J. Perreault, Juan M. Rivas, Yehui Han, Olivia Leitermann. "United States Patent 7535133 B2 Methods and apparatus for resistance compression networks", Massachusetts Institute Of Technology, May 19, 2009

LINKS

- SUPER-Lab: http://superlab.stanford.edu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Modern applications are driving demand for power systems with capabilities beyond what is presently achievable. High performance systems, like medical imaging systems and other applications impose challenging specifications on power density and bandwidth that are difficult to achieve with current circuit topologies. Power density can be improved with better semiconductor components and passive elements, and by reducing the energy storage requirements of the system. By dramatically increasing the switching frequency, it is possible to reduce the energy storage requirements and improve bandwidth. I'm interested in the development of system architectures and circuit topologies for dc-ac and dc-dc power conversion that can reach switching frequencies of 10’s to 100’s of MHz. Switching at these frequencies will lead to efficient converters with inductors and transformers having no magnetic material to limit their high frequency performance, and with small-valued capacitors.

At these switching frequencies, all inductors can be air-cored, eliminating core losses, saturation, and extending their operating temperature range. I have been involved in the development of dc-dc converter that archives a significant reduction in peak switch voltage stress, requires small passive components with low energy storage, and provides the capability for extremely rapid startup and shutdown.

Another goal of my work is to implement a value-added strategy in inexpensive printed circuit boards (PCB) by fabricating all passive devices of a power converter (inductors and capacitors) with traces, transforming the PCB into a 3-D resonant structure. This approach will eliminate tuning and component variation while simultaneously maintaining extraordinary levels of performance at reduced cost. Moreover, there a lot of exciting applications for these high frequency circuits.

Teaching

COURSES

2016-17

- Advanced Topics in Power Electronics: EE 254 (Spr)
- Power Electronics: EE 153, EE 253 (Win)

2015-16

- Advanced Topics in Power Electronics: EE 254 (Spr)
- Power Electronics: EE 153, EE 253 (Win)
- Resonant Converters: EE 356A (Aut)

2014-15

- Advanced Topics in Power Electronics: EE 254 (Spr)
- Power Electronics: EE 153, EE 253 (Win)
- Resonant Power Converters and Magnetic Design: EE 356 (Aut)

2013-14

- Power Electronics: EE 292J (Spr)

Publications

PUBLICATIONS

- **A Very High Frequency dc-dc Converter Based on a Class 2 Resonant Inverter**

Rivas, J., M., Letermann, O., Han, Y., Perreault, D., J.

- **A high-frequency resonant inverter topology with low voltage stress**
  Rivas, J., M., Han, Y., Leitermann, O., Sagneri, A., D., Perreault, D., J.
- **Very High Frequency Resonant Boost Converters**
  Pilawa, R., C., Sagneri, A., D., Rivas, J., M., Anderson, D., I., Perreault, D., J.
- **High Frequency Resonant SEPIC Converter with Wide Input and Output Voltage Ranges**
  Hu., J., Sagneri, A., D., Rivas, J., M., Perreault, D., J.
- **A 13.56 MHz High Density dc-dc Converter with PCB Inductors**
  Liang, W., Glaser, J., S, Rivas, J., M.
  2013
- **27.12 MHz large voltage gain resonant converter with low voltage stress**
  Raymond, L., Liang, W., Choi, J., Rivas, J.
  2013
- **High-Frequency Resonant SEPIC Converter with Wide Input and Output Voltage Ranges** *IEEE Transactions on Power Electronics*
  Hu, J., Sagneri, A., D., Rivas, J., M., Han, Y., Davis, S., M., Perreault, D., J.
  2012; 27 (1): 189-200
- **A Very High Frequency dc-dc Converter Based on a Class 2 Resonant Inverter** *IEEE Transactions on Power Electronics*
  Rivas, J., M., Leitermann, O., Han, Y., Perreault, D., J.
  2011; 26 (10): 2980-2992
- **A 500 W push-pull dc-dc power converter with a 30 MHz switching frequency**
  Glaser, J., S., Rivas, J., M.
  2010
- **Very-High-Frequency Resonant Boost Converters** *IEEE Transactions on Power Electronics*
  Pilawa-Podgurski, R., C. N., Sagneri, A., D., Rivas, J., M., Anderson, D., I., Perreault, D., J.
  2009; 24 (6): 1654-1665
- **Opportunities and Challenges in Very High Frequency Power Conversion**
  Perreault, D., J., Jingying, H., Rivas, J., M., Han, Y., Leitermann, O., Pilawa-Podgurski, R., C.N.
  2009
- **A High-Frequency Resonant Inverter Topology With Low-Voltage Stress** *IEEE Transactions on Power Electronics*
  Rivas, J., M., Han, Y., Leitermann, O., Sagneri, A., D., Perreault, D., J.
  2008; 23 (4): 1759-1771
- **Resistance Compression Networks for Resonant Power Conversion** *IEEE Transactions on Power Electronics*
  Han, Y., Leitermann, O., Jackson, D., A., Rivas, J., M., Perreault, D., J.
  2007; 22 (1): 41-53
- **Design Considerations for Very High Frequency dc-dc Converters**
  Rivas, J., M., Jackson, D., A, Leitermann, O., Sagneri, A., D., Han, Y., Perreault, D., J.
  2006
- **New Architectures for Radio-Frequency dc-dc Power Conversion** *IEEE Transactions on Power Electronics*
  Rivas, J., M., Wahby, R., S., Shafran, J., S., Perreault, D., J.
  2006; 21 (2): 380-393
- **Resistance Compression Networks for Resonant Power Conversion**
  Han, Y., Leitermann, O., Jackson, D., A., Rivas, J., M., Perreault, D., J.
  2005
- **Performance improvement of alternators with Switched-Mode Rectifers** *IEEE Transactions on Energy Conversion.*

Rivas, J., Perreault, D., Keim, T.
2004; 19 (3): 561-568

- **New Architectures for Radio-Frequency dc-dc Power Conversion**
  Rivas, J., M., Wahby, R., S., Shafran, J., S., Perreault, D., J.
  2004

- **Performance improvement of alternators with switched-mode rectifiers**
  Rivas, J., M., Perreault, D., J., Keim, T.
  2003