



Tuesday, April 11, 2023

2:00 pm – 3:00 pm

Olin 202

Open to the Public

Reception in Olin 204

3:00 pm – 3:30 pm

Dr. Thomas M. Jahns

Grainger Emeritus Professor of Power Electronics and Electrical Machines

WEMPEC / University of Wisconsin – Madison USA

The Promising Future of Integrated Motor Drives in Tomorrow's E-Mobility Applications

ABSTRACT:

The electrification of all modes of transportation holds great potential for significantly reducing global fossil fuel consumption and greenhouse gas emissions. A promising strategy for spurring much broader adoption of adjustable-speed motor drives is to physically integrate the power electronics *inside* electric machines, achieving major mass, volume, and cost reductions by eliminating separate enclosures and connecting cables. This tutorial explores the past, present, and future of integrated motor drives (IMDs) by first reviewing past and recent milestones in IMD developments including the underlying technologies that have both enabled and constrained them. Attention is next turned to transformative advances in wide-bandgap (WBG) power semiconductor technology (SiC and GaN) that offer exciting opportunities for shrinking the size of power converters by significantly raising their operating frequencies. Looking ahead, the case will be made for using WBG switches to spark a revival of current-source inverters (CSIs) for future machine drives. Recent IMD research projects at UW-Madison covering a wide range of power ratings from 3 kW to 1 MW will be briefly reviewed. These projects will be used to highlight the impressive progress that is being made worldwide to extend the boundaries of IMD technology in demanding high-performance applications ranging from electric vehicle traction drives to electrified aircraft propulsion drives. The presentation will conclude with a review of both the opportunities and challenges presented by WBG switches for realizing the full potential of integrated motor drives during coming years.

BIO:

Thomas M. Jahns received his PhD and combined MS/BS degrees in electrical engineering from the Massachusetts Institute of Technology in 1978 and 1974, respectively.

In 1998, Dr. Jahns joined the Department of Electrical and Computer Engineering at the University of Wisconsin-Madison as a Grainger Professor of Power Electronics and Electric Machines, where he served as Co-Director/Director of the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) for 14 years from 2007 to 2021. Prior to joining UW, he worked at GE Corporate Research and Development (now GE Global Research Center), in Niskayuna, NY, for 15 years. Since his retirement from the active faculty in 2021, Dr. Jahns is continuing to pursue research as a Grainger Emeritus Professor in the areas of high-performance permanent magnet machines, and integrated motor drives using wide-bandgap switches.

Dr. Jahns received the 2005 IEEE Nikola Tesla Technical Field Award and the IAS Outstanding Achievement Award in 2011. He has served both the IEEE Industry Applications Society and Power Electronics Society (PELS) as a Distinguished Lecturer. Dr. Jahns is a Past President of PELS and served two years as Division II Director on the IEEE Board of Directors (2001-2002). He was elected as a member of the US National Academy of Engineering in 2015 and received the IEEE Medal in Power Engineering in 2022.