
Electrical & Computer Engineering
S E M I N A R
Louisiana State University

Energy Conversion for a Sustainable Future

Ayman El-Refaei

Marquette University

Abstract—Energy sustainability is arguably one of the most critical challenges for a sustainable future. With predictions showing future scarcity and/or higher degree of extraction difficulty of traditional sources of energy for example coal, oil and natural gas, the shift to sustainable clean sources of energy is a must. Another key reason is the increasing detrimental impact of using fossil fuels. Over the last few decades, there has been serious effort to replace mechanical and hydraulic systems with electrical systems. This effort also includes replacing fixed-speed and old electrical drives with higher performance variable-speed drives. This is mainly due to the higher reliability, efficiency and robustness of electrical systems. This trend of “more electric” systems could be seen across a wide range of applications. These include traction, aerospace, actuation, mining, oil & gas, and industrial applications as examples. This push for electrification posed a lot of challenges to develop electrical systems that meet the demanding requirements of the various applications including harsh environments, high power density, high efficiency and fault tolerance in safety-critical applications. At the heart of the electrification effort is the development of advanced electrical machines and drives. This presentation will provide an overview of the various applications where electrification is taking place. The presentation will focus on electrical machines and drives that have been developed or are currently under development. The presentation will also cover some general trends in electrical machines and potential areas of research.

Bio—Ayman M. El-Refaei received the M.S. and Ph.D. degrees in electrical engineering from the University of Wisconsin Madison on 2002, and 2005 respectively. Between 2005 and 2016, he has been a principal engineer and a project leader at the Electrical Machines and Drives Lab at General Electric Global Research Center. Since January 2017, he joined Marquette University as the Thomas and Suzanne M. Werner Endowed Chair in sustainable and secure energy. His interests include electrical machines and drives. He has 40 journal and 60 conference publications, with several others pending. He has 31 issued US patents and 28 US patent applications, with several others pending. At GE, he worked on several projects that involve the development of advanced electrical machines for various applications including, aerospace, traction, wind, and water desalination. He was the program manager and principal investigator of a \$5.6M DOE-funded project to develop next generation traction motors for hybrid vehicles. He is currently the program manager and principal investigator of a \$12M DOE-funded project to develop next generation traction motors for hybrid vehicles that do not include rare earth materials. He received several management awards at GE including the prestigious 2011 Albert W Hull Award, the highest individual award for early career researchers. Also he received “The 2009 Forward Under 40” from the Wisconsin Alumni Association awarded to outstanding University of Wisconsin alumni under the age of 40 and the IEEE Industry Applications Society (IAS) “2009 Andrew W Smith Outstanding Young Member Award”. He was the chair for the IEEE IAS Transportation Systems committee and an associate editor for the Electric Machines committee. He was a technical program chair for the IEEE 2011 Energy Conversion Conference and Exposition (ECCE). He was the general chair for ECCE 2014 and 2015 ECCE steering committee chair. He is a member-at-large in the IEEE Industry Applications Society executive board. He is an IEEE Fellow and a member of Sigma Xi since 2006. He is a member of the electrical machines and industrial drives committees. He is a reviewer of 6 IEEE Transactions as well as several other international journals and conferences. He is the recipient of two paper awards.

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