Electric Power and Power Electronics Institute

WEEKLY SEMINAR SERIES – FALL 2017

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ELECTRIC PROPULSION FOR COMMERCIAL TRANSPORT AIRCRAFT

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Abstract

The global aviation industry emitted 781 million tons of CO2 in 2015 - a number that is projected to triple by 2050 without new policies. Ambitious goals have been set by the aerospace industry for the next three generations of commercial transport aircraft to ensure sustainability of the industry. This includes a better than 70% reduction in aircraft fuel burn, along with significant reduction in noise and other emissions. These challenging goals require the development of disruptive technologies beyond the current trends in the aviation industry. One approach being explored to meet these targets is the use of electric/hybrid-electric propulsion. Studies show that commercial transport aircraft with a 'turboelectric distributed propulsion system' is able to reduce the mission fuel burn by 70-72% on an intercontinental mission without compromising payload, range or cruise speed. This is accomplished by using an electric propulsion system that decouples the power producing parts of the system from the thrust producing parts. The industry is also considering other intermediate opportunities for inserting electrical propulsion technologies into airplanes, including the use of 'fuselage boundary layer ingestion' on a single aisle airplane, which is projected to achieve up to 12% reduction in fuel burn. Small electric aircraft are already being produced and offered commercially, but significant challenges prevent scaling up of the technology to commercial aviation. Technology gaps include the availability of flight-weight motors, generators and transmission lines. Megawatt scale electrical machines and drives with specific power better than 6kW/kg will be required to make these systems viable. This talk will describe the application space, the current state-of-the-art, and key enabling technologies that are being developed.

Biography

Kiruba Haran obtained a PhD in Electric Power Engineering from the Rensselaer Polytechnic Institute, Troy, NY, in 2000. He spent 13 years as a senior engineer and manager of the research group developing advanced electrical machine technology for all of GE's industrial businesses. He moved to the University of Illinois in 2014 as an Associate Professor and Associate Director of the Grainger Center for Electric Machinery and Electromechanics. His research focus in recent years has been on high specific power electrical machines and drives, with both superconducting and non-cryogenic approaches. Dr. Haran holds 40 issued patents and has published over 70 journal and conference papers. He serves on the Steering Committee of the IEEE Transportation Electrification Community, and the editorial board of the IEEE Transactions on Energy Conversion. He is also the current Chair of the Electric Machinery Committee and a Distinguished Lecturer of the IEEE Power and Energy Society. Dr. Haran is a registered Professional Engineer in New York and is a Fellow of the IEEE.