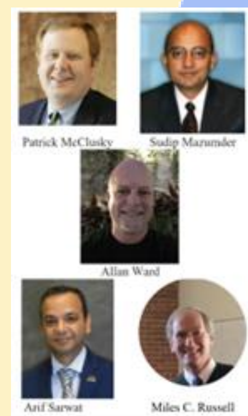
IEEE MIAMI SECTION | **IEEE VTS – Connecting the Mobile World** | **IEEE COMMUNICATIONS SOCIETY**

IEEE Communication Society and IEEE Vehicular Technology Society – Joint Chapter – Technical Meeting.

Panel Discussion

"Reliability of Power Electronics and Solar PV Systems"



Panelists: **Dr. Allan Ward (Department of Energy, Solar Energy Technologies Office)**
Prof. Patrick McClusky (University of Maryland)
Prof. Sudip Mazumder (University of Illinois Chicago)
Mr. Miles Russel and Mr. Matt Ursino (Yaskawa Solectria Solar)

Host: **Prof. Arif Sarwat (Florida International University)**

Date: **Tuesday, January 31, 2023**

Time: **03:00 PM – 04:00 PM, EC 3920, Florida International University (FIU), EC Campus, 10555 W Flagler St Miami, Florida 33174**

Theme of the Session:

Reliability is a critical aspect of power electronics and solar PV systems as it ensures that these systems can function without fail over an extended period. Power electronics are used to convert and control the flow of electrical energy, and their reliability is crucial for maintaining stable power supply in various applications such as renewable energy systems and electric vehicles. Solar PV systems, on the other hand, rely on the reliability of photovoltaic panels and inverters to convert solar energy into usable electrical energy. The reliability of these components is critical for the overall performance and lifespan of the solar PV system. The system must be able to withstand harsh environmental conditions and maintain a high level of efficiency to provide reliable and sustainable power. Regular maintenance and monitoring of these systems can help ensure their reliability over time.

Inverter failure accounts for a significant portion of solar plant maintenance costs, up to 50%. This is partly due to the time and effort required to fix issues with solar inverters, which leads to power and revenue loss for end customers or project developers. For example, a 2–3-week inverter shutdown in a year can result in a 5% loss of energy and revenue. To improve reliability and mitigate these issues, an integrated approach is needed that includes analyzing field data, using Physics of Failure (PoF) models to assess component degradation and failure, and determining the effects of different operating conditions on component stress. One way to achieve this is to create a test-bed inverter and a digital twin of that inverter, which can then be used to assess reliability after periods of aging and degradation.

Developing a digital twin of a power inverter can be a valuable tool for understanding reliability. The digital twin can use field failure data to identify and classify failure mechanisms and failure site groups based on different environmental and operational conditions. It can also use stress-defining algorithms to convert environmental and operational exposure into electrical, chemical, mechanical, and thermal stresses acting on critical components in the inverter. By combining this information with physical knowledge of the effects of these stresses on key components, the digital twin can then specify key failure mechanisms and components and use physics of failure algorithms to calculate the level of degradation and the time to failure for these components under different conditions. The digital twin can also use these models to determine the level of degraded performance or time to failure for the entire inverter for different failure mechanisms.

For more information, please contact:

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