ECE 590 I
POWER & ENERGY SYSTEMS SEMINAR

Monday, September 13, 2021, 3:00 – 3:50 p.m.

Zoom Meeting ID: 826 3892 4416
Password: seminar_21

Reliability of Proposed Offshore Wind Energy Conversion Systems

Isaac Lawanson, Electrical and Computer Engineering, UIUC

Abstract: System-level failure rates and availabilities of various power converter architectures for a proposed offshore wind energy conversion system are determined from the solution of the Chapman-Kolmogorov equations for the Markov reliability and availability models. Sensitivity analysis studies of the system-level failure rates and availabilities are performed to quantify the impacts of failure and repair rates of specific components in the architectures proposed. These studies are carried out by scaling the failure/repair rates of the specific component under study, with all other components' rates held fixed to allow the comparison of the variation effects on the metrics of interest. Each study is performed on a baseline architecture with an active rectifier, a proposed architecture with an active rectifier and multiple passive rectifiers, and a second proposed architecture with bypass structure that isolates failed passive rectifiers from the complete converter architecture by means of electromechanical relays. This work is part of the Advanced Project Research Agency – Energy (APRA-E) project funded since June 2019.

Economic Analysis of an Offshore Wind Farm Deploying the Proposed Direct-Drive Permanent Magnet Synchronous Generator

Daniel Mulas Hernando, Electrical and Computer Engineering, UIUC

This presentation discusses the economic assessment we performed for the proposed permanent magnet synchronous generator (*PMSG*) design with its associated power electronics (*PE*) topology. Specifically, we evaluate the key metrics of interest including the expected annual energy generation, the design cost density of the system, the energy yield per total cost of the system, the capacity factor, and the levelized costs of energy for the proposed *PMSG* design with its associated *PE* topology. We use component-wise cost and reliability data to determine the fixed costs and the operations and maintenance costs of a single generator. We perform a comparative analysis of the proposed design (*p.d.*) and the selected reference design (*r.d.*). We extend the single-unit analysis to the assessment of varying sizes of offshore windfarms that incorporate the *p.d.* and the *r.d.* The assessment is based on a probabilistic representation of wind speed and uses simulation studies under five distinct wind regimes. The improvements in the performance of the *p.d.* over that of the *r.d.*are quantified for the different sized wind farms under assessment. This work is part of the Advanced Project Research Agency – Energy (APRA-E) project funded since June 2019.