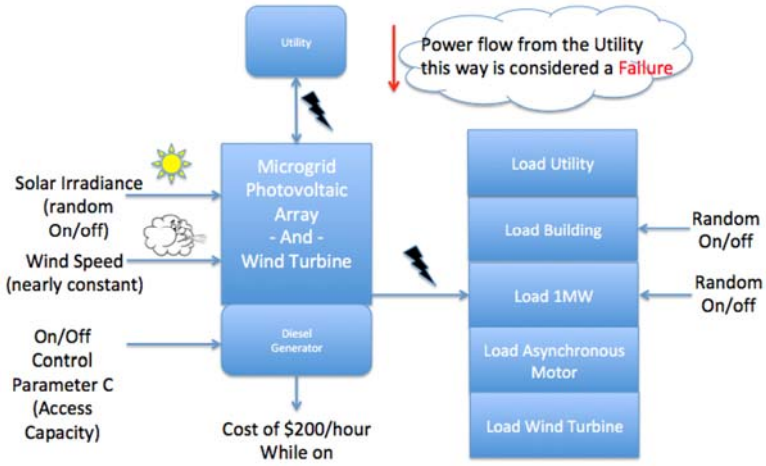
Oakland University student develops optimal operation of microgrid utilizing repairable systems theory

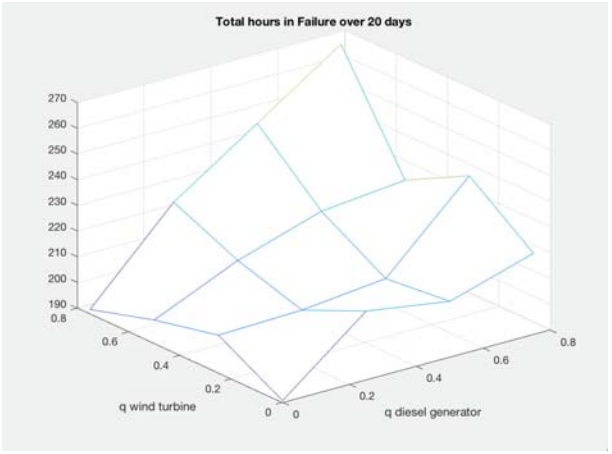
The Oakland University and School of Engineering and Computer Science communities are invited to attend Annette Skowronska's defense of her Ph.D. dissertation. Seating is limited. RSVP with Katie Loodeen at loodeen@oakland.edu.

RELIABILITY AND OPTIMAL OPERATION OF REPAIRABLE SYSTEMS WITH APPLICATION TO A SMART CHARGING MICROGRID WITH VEHICLE-TO-GRID CAPABILITY

Time: **10:00 a.m. – 12:00 p.m.**
Date: **Wednesday, August 7, 2019**
Location: **347 EC**

Committee: Zissimos Mourelatos, Ph.D. (Chair), Dorin Dringei, Ph.D.,Vijitashwa Pandey, Ph.D., Lianxiang Yang, Ph.D., Amandeep Singh, Ph.D.





Optimizing the trade-off between reliability and cost of operating a microgrid, including vehicles as both loads and sources, is a challenge. Optimal energy management is crucial in developing strategies to improve the efficiency and reliability of microgrids. In addition, the optimal energy management must not only consider the variations in loads and sources, but also physical failures and maintenance of subsystems in the microgrid. Failure is defined as the inability of power sources to meet load requirements without the need for an external utility grid. Prior modeling approaches of a microgrid do not include detailed physics of loads and sources, and therefore, miss the transient effects that are present in real time operation of a microgrid. This research discusses the implementation of a physics-based detailed microgrid model including a diesel generator, wind turbine, photovoltaic array and utility. All elements are modeled as sources in MATLAB Simulink. Various loads are also implemented including an asynchronous motor. It is shown how a central control algorithm optimizes the microgrid by trying to maximize reliability while reducing operational cost utilizing repairable systems theory. The performance of the proposed central control algorithm is validated through simulation results for different scenarios and the results are compared.