

EECS Graduate Seminar

Population-based Intelligent Search in Reliability Evaluation of Hybrid Generation Systems with Wind Power Penetration

By

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Abstract: Reliability evaluation of power-generation systems provides a mechanism to ensure proper system operations in the face of equipment failures. The integration of time-dependent sources such as wind turbine generators (WTGs) makes the reliability evaluation process more challenging. Due to the large number of system states involved in system operations, it is normally not feasible to enumerate all possible failure states to calculate the reliability indices. Monte Carlo simulation (MCS) can be used for reliability evaluation through iterative selection and evaluation of system states. However, the simulation may be time-consuming and take a long time to converge in some evaluation scenarios. In this study, as an alternative option, the method of Population-based Intelligent Search (PIS) is proposed and several representative PIS algorithms are adopted to search for meaningful system states through their inherent convergence mechanisms. These most probable failure states contribute most significantly to the adequacy indices including loss of load expectation (LOLE), loss of load frequency (LOLF), and expected energy not supplied (EENS). The proposed method is also compared with the Monte Carlo simulation via conceptual analyses and numerical simulations. A modified IEEE Reliability Test System (IEEE-RTS) is used in this investigation. Some relevant work in the field of renewable energy integration will also be mentioned in this talk.