Award Details

Dynamic Modeling and Control of Hybrid Power Systems

Research Details

Competition Year:	2019	**Fiscal Year:**	2019-2020
Project Lead Name:	Iqbal, Mohammad	**Institution:**	Memorial University of Newfoundland
Department:	Engineering and Applied Science, Faculty of	**Province:**	Newfoundland and Labrador
Award Amount:	28,000	**Installment:**	1 - 5
Program:	Discovery Grants Program - Individual	**Selection Committee:**	Electrical and Computer Engineering
Research Subject:	Energy conversion and distribution	**Area of Application:**	Electrical energy
Co-Researchers:	No Co-Researcher	**Partners:**	No Partners

Award Summary

Power systems that include conventional generation and renewable energy sources are called hybrid power systems. Canada has hundreds of remote isolated diesel-powered communities and many people live off-grid. Each remote community and isolated home can potentially use a more effective hybrid power system to supply power needs. The optimal sizing of a hybrid power system depends on the configuration of system components and cost analysis. The analysis and design of hybrid power systems is complex because of the nonlinear power characteristics of the components, e.g., wind turbine, PV system, energy storage, backup generator, and the load. Hybrid power systems also require optimal dynamic and supervisory controllers and may involve AC as well as a DC bus.******The objectives of the proposed research program are to develop new predictive models and optimal control systems and components for small hybrid power systems. This research will integrate subsystem level models of small wind turbines, photovoltaic solar cells, batteries, and generators to develop new dynamic models of hybrid power systems. System controllers will be designed with the simulation results of hybrid power system models. More specifically, the research program will develop and identify: (1) new methods to determine a reduced order dynamic model of hybrid power systems that could be simulated more quickly than existing models; (2) intelligent control methods including supervisory controllers and ultra-low power data loggers; (3) a new linear parameter varying controller and a fuzzy supervisory controller for hybrid power systems and determine the best operational strategy; and (4) a low voltage nano-grid to power remote houses with distributed battery storage and renewable sources including a dynamic and supervisory controller for optimal operation. The research will develop a method to eliminate circulating currents between converters in hybrid power systems when such converters are working in synchronous and asynchronous switching modes. Also, it aims to develop a new method for reliability analysis of small remote hybrid power systems. The reduced order modeling and design of new ultra-low power controllers and data loggers are innovative since they will positively impact simulation techniques and phantom losses in hybrid power systems. The proposed research on a nano-grid will design a new supervisory controller and resolve its associated converters issues.******The proposed research program will lead to new knowledge on hybrid power systems, their design, control, instrumentation, data logging, and reliability analysis. The research will enhance the adoption of renewable energy in Canada thereby helping to meet its commitment to reduce emissions and improves the lives of people living in remote northern communities. This research will also train ten graduate students on hybrid renewable power systems, hence developing the needed HQP for the renewable energy industry in Canada.*****