Control and Renewable Energy Lab

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People

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2 Post docs, 1 Research Assistant, and 4 PhD Students

Research Topics

Wind Turbine Control

The controller for a wind turbine has the basic objective of ensuring that the turbine operates according to its design strategy; that is, rotor torque, rotor speed and power are maintained at the appropriate values according to wind speed to capture as much energy as possible and also to ensure that the safe mechanical and electrical limits are not exceeded to protect the turbine.

Modern wind turbine controllers usually achieve the basic objectives very well. The focus is now on reducing various structural loads on the blades, rotor and drive-train to reduce O&M costs and to improve their life-span.

Wind Farm Control

Overall, 1,592 TWh of electricity were generated from wind installations in 2020. With such high penetration of wind power, the power generated by wind farms can no longer simply be that dictated by the wind speed – note that the power generated by each turbine *is* dictated by the wind speed.

It will be necessary for wind farms to provide services to the national grid including assistance with supply-demand matching by developing a wind farm controller; that is, wind farm controllers need to be designed for the wind farms to produce the power output requested by the grid.

Industrial, Research and Overseas Collaborators

We closely collaborate with various research, industrial and overseas partners, including:

Korea Electric Power Corporation

Korea Institute of Energy Research

Korea Electrotechnology Research Institute

Korea Institute of Machinery and Material

Technical University of Denmark

University of Strathclyde, UK

ORE Catapult, UK

Many more ...

Ongoing Projects

National Research Foundation of Korea (NRF) grant through the Korean Government (the Ministry of Science and ICT), June 2021 – Feb 2024, Optimal Control of Floating Offshore Wind Turbines.

Korea Electric Power Corporation (KEPCO), Feb 2021 – Jan 2024, Coordinated Control for Large-Scale Wind Farms.

Korea Institute of Energy Technology Evaluation and Planning (KETEP) grant funded by the Korea government (MOTIE), May 2021 – Apr 2024, Development of Domestic Control System for Wind Power Systems.

Korea Institute of Energy Technology Evaluation and Planning (KETEP) grant funded by the Korea government (MOTIE), Oct 2020 – Dec 2022, Development and Demonstration of Integrated O&M Service Solution for Digital-Based Offshore Wind Power Plant.

Korea Institute of Energy Technology Evaluation and Planning (KETEP) grant funded by the Korea government (MOTIE), Feasibility Study on 40-Year Wind Turbine.

Journal Publications (since 2021)

Balakrishnan, R. K. and **Hur, S.** (2022). Maximization of the Power Production of an Offshore Wind Farm. Applied Sciences, volume 12(8), 4013.

Routray, A. and **Hur, S.** (2022). Leakage Current Mitigation of Photovoltaic System Using Optimized Predictive Control for Improved Efficiency. Applied Sciences, volume 12(2), 643.

Reddy, Y. and **Hur, S.** (2021). Comparison of optimal control designs for a 5MW wind turbine. Applied Sciences, volume 11(18), 8774.

Hur, S. and Reddy, Y. (2021). Neural Network-Based Cost-Effective Estimation of Useful Variables to Improve Wind Turbine Control. Applied Sciences, volume 11(12), 5661.

Reddy, Y., Hwang, J. and **Hur, S.** (2021). Evaluation of Optimal Control Designs for a 5 MW Wind Turbine. Journal of Wind Energy, volume 12, issue 1, 36-44.

Hur, S. (2021). Short-term wind speed prediction using Extended Kalman filter and machine learning. Energy Reports, volume 7, 1046-1054.

Hur, S. (2021). Reliable and cost-effective wind farm control strategy for offshore wind turbines. Renewable Energy, volume 163, 1265-1276.