

Graduation Design Project Proposal Form

Project # P16

Project Title:

Design of a Centralized Control System for Optimal Operation of Distribution Networks with Renewable Energy Sources

Professor(s) Name(s): 1. Majed Alotaibi
2. Abdullah Alshaalan

Number of Students: Two

Students Qualifications

The students should have good background in electric power systems and distribution network engineering, in particular. Students also should have basic skills in Matlab.

Statement of Problem

High penetration level of Renewable Energy Sources (RES) might adversely affect the operational security of power distribution networks leading to some operational issues such as voltage rise in some areas, thermal overloading in feeders, and high reverse power. The risk associated with the increased capacity and the uncertainty of RES output power must be quantified and mitigated. The objective of this project is to design and optimize the operation actions of the control system to operate the distribution system in the most efficient and secure way.

Brief Description of the Project

This project aims to achieve a deep understanding of the distribution system design and operation. The students will address the operational risks caused by the variability of RES in distribution networks and investigate several approaches to minimize these risks. The control system would also coordinate among different components in the network, such as transformer tap changers, voltage regulators, and capacitor banks. Moreover, the coordinated between voltage control devices and system reconfiguration will be executed. Some of design aspects and control actions will be applied to ensure service continuity and high system quality.

Objectives

- (1) To understand the operation of the distribution system and its main components.
- (2) To assess the risk associated with hosting high penetration level of RES in distribution networks.
- (3) To design a centralized control system for optimizing the system operation and control actions.

Technical Approach and Expected Deliverables

- Review the voltage control methods applied in the literature.
- Model the distribution system and its main equipments.
- Assess the risks associated with the fluctuation of RES output power.
- Design a centralized control system to manage system operation.
- Perform load flow analysis using Matlab.
- prepare a final Project Report summarizing the main findings and outlining the results obtained throughout the project.

