UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

Department of Electrical Energy Systems (EES)

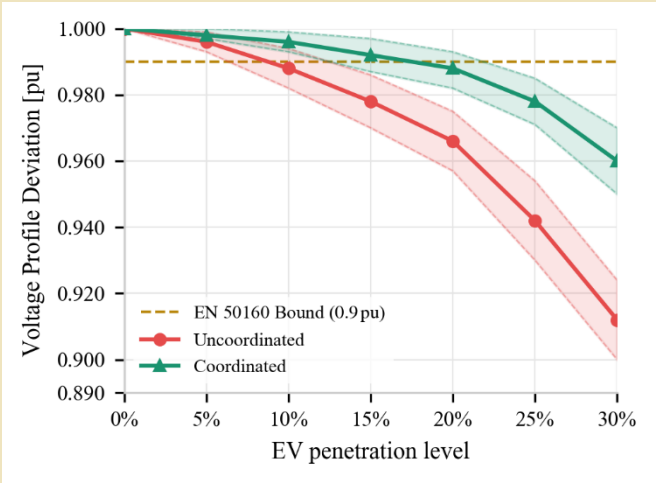
Rule-Based Droop Control for EV Hosting Capacity Enhancement in Low-Voltage Distribution Networks: A Probabilistic Assessment

Motivation

- The rapid uptake of electric vehicles (EVs) poses significant voltage quality challenges in low-voltage (LV) distribution networks. Uncoordinated EV charging during evening peak hours causes voltage drops limits (±10% of nominal voltage), threatening network stability. Rule based Droop-based behind-the-meter (BTM) control offers a cost-effective, decentralized mitigation strategy that requires no communication infrastructure, making it highly relevant for distribution system operators (DSOs) across Europe.

Objective and Work Steps

- This thesis develops and evaluates a rule-based volt-watt/volt-var droop control strategy for EV charging in LV networks, without relying on any numerical optimization. The student will: (1) build the IEEE European LV Test Feeder in DIgSILENT PowerFactory or in pandapower; (2) uses rule based droop gains based on European grid code principles; (3) implement a Monte Carlo simulation loop (200+ iterations per EV penetration levels) with stochastic EV driver behavior and EV charging uncerteinities ; (4) compute EV hosting capacity curves for both the baseline and the droop-controlled scenarios; The expected result is a statistically robust hosting capacity and demonstrating the benefit of rule-based droop control under realistic EV uncertainty conditions.



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