Smart Energy Systems

Winter 2020-2021

Optimization Project Group

Milestone 4

Attachment I: bg1.pdf

The objective of this milestone is to investigate variance reduction techniques and equip your optimization framework with an electric vehicle (EV) charging station.

Task Descriptions:

1. Investigate the influence of the number of Monte Carlo samples generated using the Antithetic Variates (AV) technique by varying the number of samples from 10^2 to 10^6 on a base-10 log scale and fix the first-stage decisions obtained under each number of samples. Subsequently, generate 1000 new samples and compute the mean and the variance of the optimal cost with the fixed first-stage decisions associated with each number of samples.

2. Repeat Task 1 by generating samples using the Latin Hypercube Sampling method.

3. Compare the mean and variance values obtained under Tasks 1 and 2 of this assignment with those obtained under Task 1 of Milestone 3.

4. Analyze the influence of concurrent.futures module by performing Tasks 1 and 2 for sample sizes from 10^2 to 10^4 without using the concurrent.futures module.

5. Consider that an electric vehicle (EV) that supports vehicle-to-grid technology is connected to the microgrid. The energy storage capability of the EV battery is 38 kWh and the maximum charging/discharging power is 11 kW. Assume that the initial energy stored in the EV battery is 20% and the EV battery needs to be at 80% at the end of the last hour. Formulate the constraints for EV charging. Repeat Task 1. Study the sensitivity of

the battery state of charge target for the end of the last hour by varying it from 20% to 100% in 10% increments.

Expected Outcome:
You are asked to

1. send me your source code by no later than 10 a.m. on February 9, 2021 at yurdakul@tu-berlin.de.

2. prepare a slide set depicting the work you carried out as well as the results you obtained. The prepared slide set is to be presented in class on February 9, 2021; the duration of the presentation is 15 minutes.

Supplementary Material:

1. Attachment I: bg1.pdf

2. Bayraksan, Güzin. "Mini Courses - SVAN 2016 - MC1 - Class 04 - Scenario Generation And Sampling Methods." YouTube, 20 Oct. 2017, `https://www.youtube.com/watch?v=RkUdWL_3KLA`.