Objective & Motivation

Day-ahead Optimal Scheduling

- The proposed method uses the PV inverter, OLTC, and SCB to minimize:
  - Node voltage deviation
  - Power losses
- The optimal scheduling for the next day is based on:
  - the forecast values of PV real power generation
  - The forecast values of load demand.

Optimization Problem

- Decision variables:
  \[ x = \{Q^t_{PV}, Tap^t, SC^t\}, t = 1,2, ..., T \]
- Objective function:
  \[ F = \sum_{t=1}^{T} (w_1 \times \sum_{i=1}^{N_{node}} (V_i^t - V_{Mi})^2 + w_2 \times \sum_{j=1}^{N_{PV}} P_{j}^t) \]
- Constraints:
  - Distribution power balance equations:
    \[ P_k = V_K \sum_{n=1}^{N_{PV}} V_n \cos(\delta_k - \delta_n - \theta_{kn}) \]
    \[ Q_k = V_K \sum_{n=1}^{N_{PV}} V_n \sin(\delta_k - \delta_n - \theta_{kn}) \]
  - Reactive power limit of PV generation:
    \[ -\sqrt{S_{PV}^2 - (P_{PV}^t)^2} \leq Q_{PV}^t \leq \sqrt{S_{PV}^2 - (P_{PV}^t)^2} \]
  - Limit of tap position:
    \[ Tap^U \leq Tap^t \leq Tap^U \]
  - Limit of the tap operations within a day:
    \[ TTO \leq TTO_{max} \]
  - Limit of the shunt capacitor operations within a day:
    \[ TSC \leq TSC_{max} \]

- The proposed problem is a constrained, non-convex, mix-integer optimization problem:
  - Reactive power of PV inverter (continuous variables)
  - Tap position of OLTC (discrete variables)
  - Switch state of SCB (Boolean variables)

- Algorithms:
  - The Pattern Search Algorithm
  - The Genetic Algorithm.

References