Determination Method of Voltage Control Parameters Based on Input-output Relationship Database in Distribution System

Mr. Shinya Yoshizawa (Waseda University)

Background and objective

Difficulty of voltage control

- The number of photovoltaic (PV) generation is increasing
- Voltage rise and fluctuation problems
- Diversification in consumption behavior and weather variation

Advanced voltage management methodology

- Voltage control parameter of voltage regulator is determined and updated every one hour
- For control parameter determination, Input-output relationship database is used

Flow of proposed approach

Forecast

Energy demand and PV output profiles are forecasted by Just-in-Time modeling and *k*-Nearest Neighbor approach.

Operational plan

Appropriate voltage control parameter is determined by using an input-output relationship database.

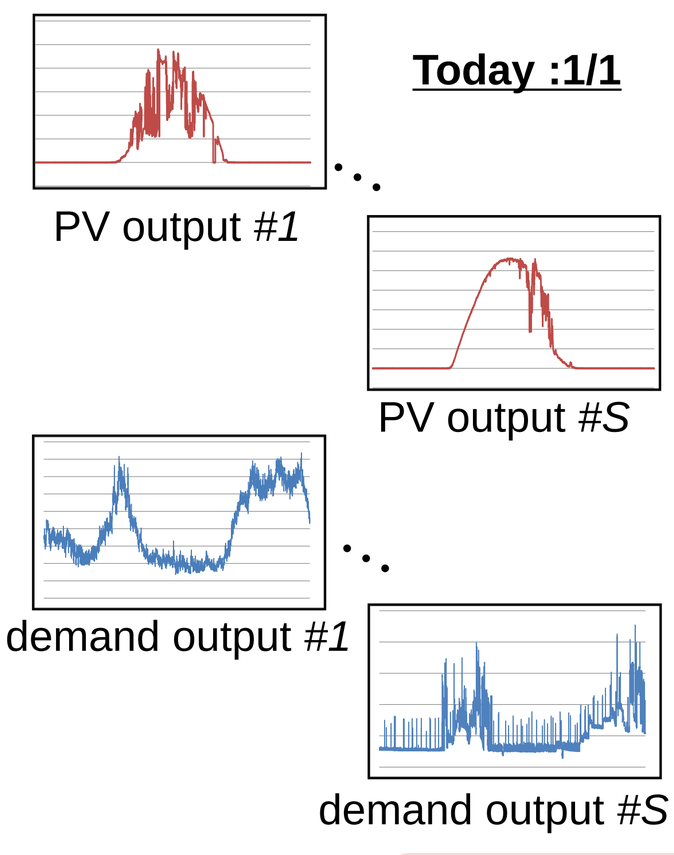
Voltage control

Voltage regulator automatically operates according to the determined control parameter

Determination approach for voltage control parameters

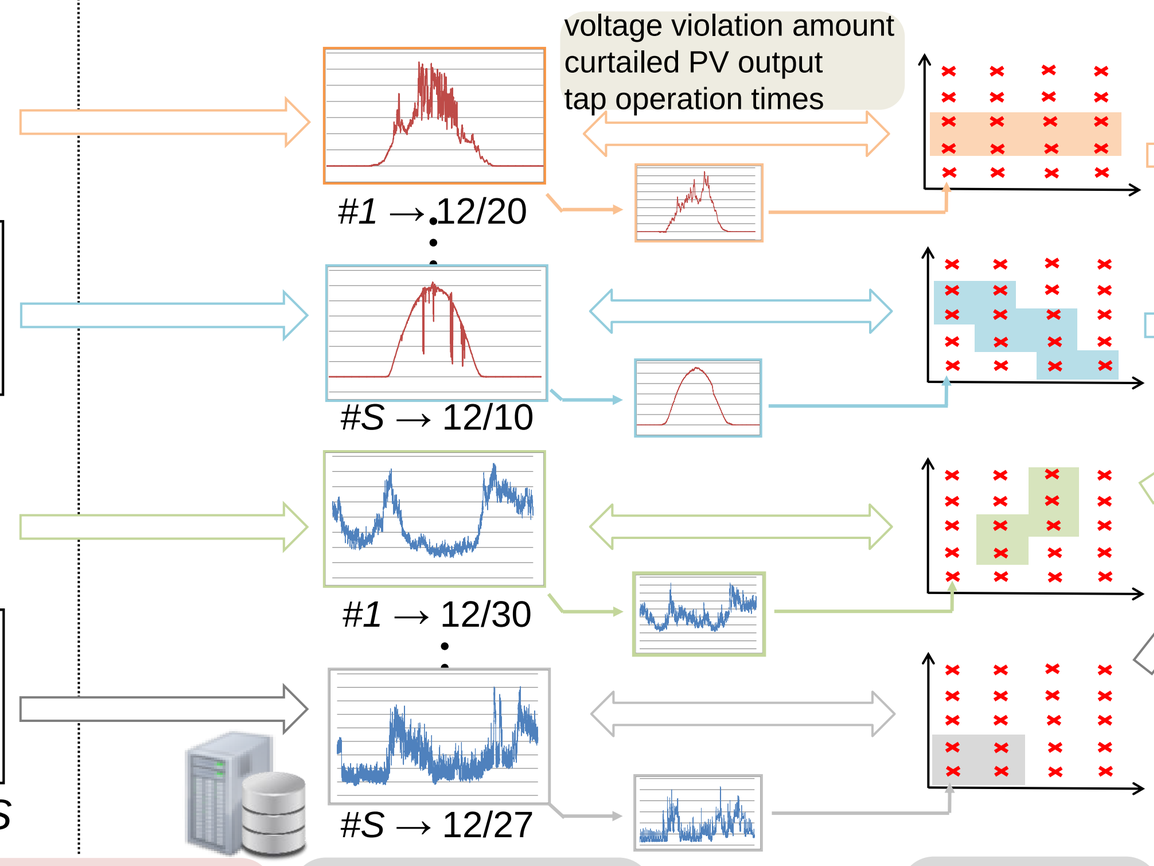
Input data

- Forecasted scenarios of energy demand and PV output are inputted.



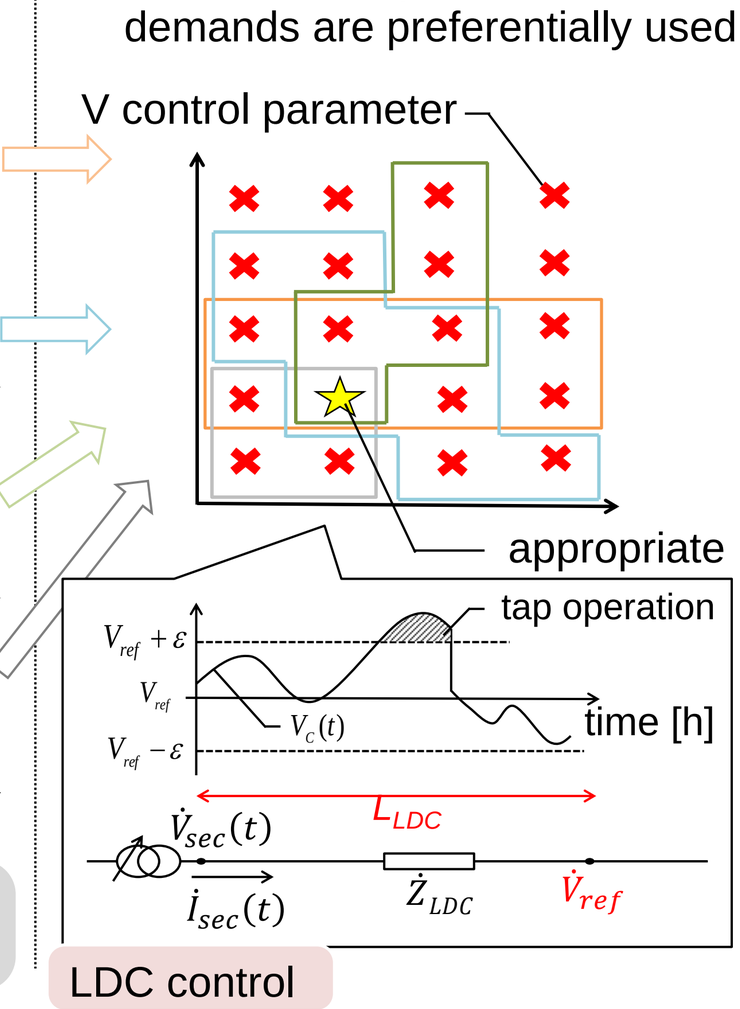
Parameter candidates is selected *from* DB

- Relationship between past forecasted profiles and feasible parameter candidates are stored in DB.



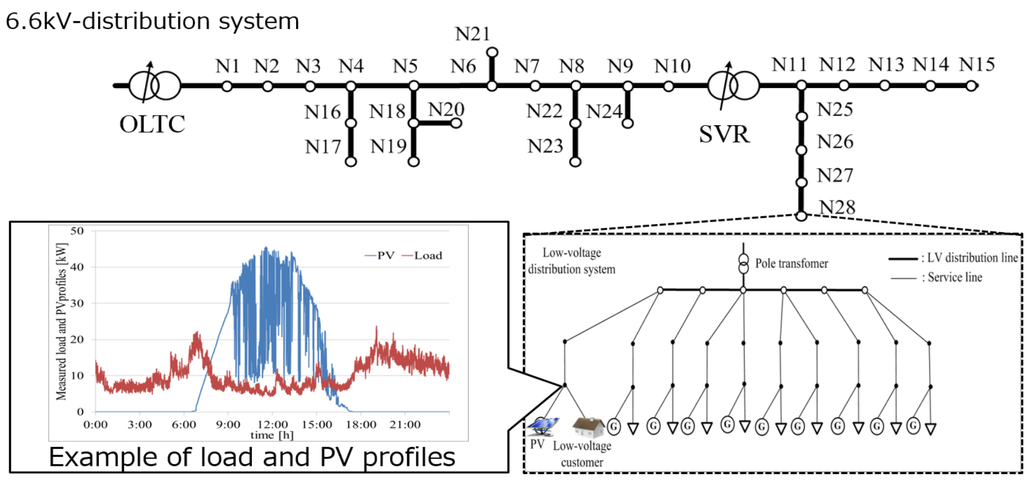
Output data

- Common parameter is selected.
  * if no common parameters, demands are preferentially used



Simulation conditions

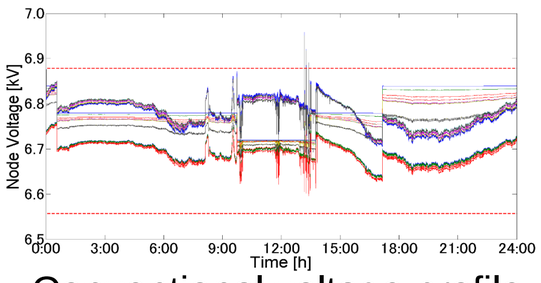
- Actual Japanese 6.6-kV distribution system model
  - ✓ Total load capacity : 2971 kVA
  - ✓ Number of 6.6-kV (MV) customers : 14
  - ✓ Number of LV-customers with PV : 479
- Simulation conditions
  - ✓ Data retention period in DB: 01/01/2007 ~ 12/31/2007
  - ✓ Evaluation period : 01/01/2008 ~ 01/31/2008



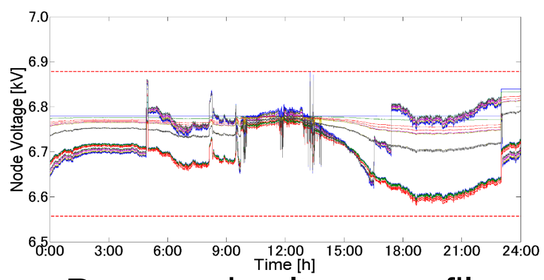
Example of load and PV profiles

Results and discussion

- Proposed voltage control approach reduces the amount of voltage violation and curtailed PV output without increasing the average number of tap operations



Conventional voltage profile



Proposed voltage profile

	Average number of tap operations		Average amount of voltage violation [V·s]
	OLTC	SVR	
Conventional method	3.93	3.00	43.5×10^3
Proposed method	3.20	4.93	0.179