Transmission Constrained Economic Dispatch

A Public Goods Approach

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The Model and Problem

Network of generators and consumers. We wish to find the social welfare maximizing set of injections subject to

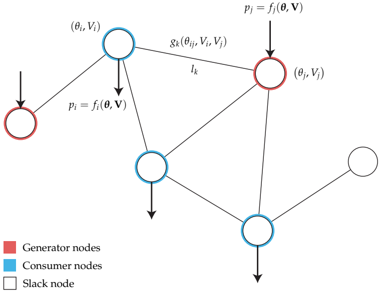
1. Informational constraints
   - Asymmetric information
2. Physical constraints and losses

Resulting problem with loss sharing:

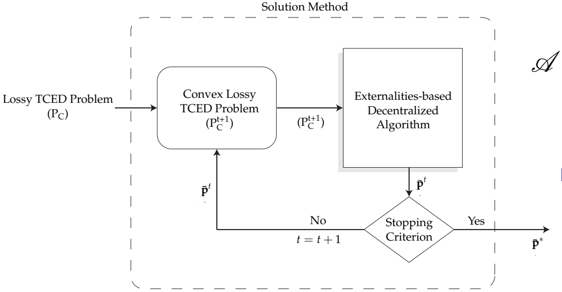
$$\min_{\mathbf{p}} c_0 \left(-\mathbf{1}^\top \mathbf{p} + \alpha_0 p_L(\mathbf{p})\right) + \sum_{i \in \bar{\mathcal{N}}} c_i \left(p_i + \alpha_i p_L(\mathbf{p})\right)$$

$$\text{subject to} \quad p_i + \alpha_i p_L(\mathbf{p}) \in [\underline{M}_i, \bar{M}_i], i \in \bar{\mathcal{N}}$$
$$-l_k \leqslant X_k(\mathbf{p}) - Y_k(\mathbf{p}) \leqslant l_k, \ k \in \mathcal{L}$$

Above problem is non-convex.



Solution Methodology



$$\mathscr{A}(z) = \underset{\mathbf{p}}{\operatorname{argmin}} \left\{ C(\mathbf{p}) : \mathbf{p} \in \hat{\Omega}(z) \right\}$$

- Sequence of solutions generated as $\mathbf{p}^{t+1} = \mathscr{A}(\mathbf{p}^t)$

Theorem

The sequence of solutions, $\{\mathbf{p}\}_{t=0}^{\infty}$, converge to a local optimum of the non-convex problem while satisfying the informational constraints.