GO Challenge 2:

Electric Stampede's Approach

Kyri Baker, Constance Crozier, and Javad Mohammadi

University of Colorado Boulder

TEXAS
The University of Texas at Austin

GRID OPTIMIZATION (GO) COMPETITION

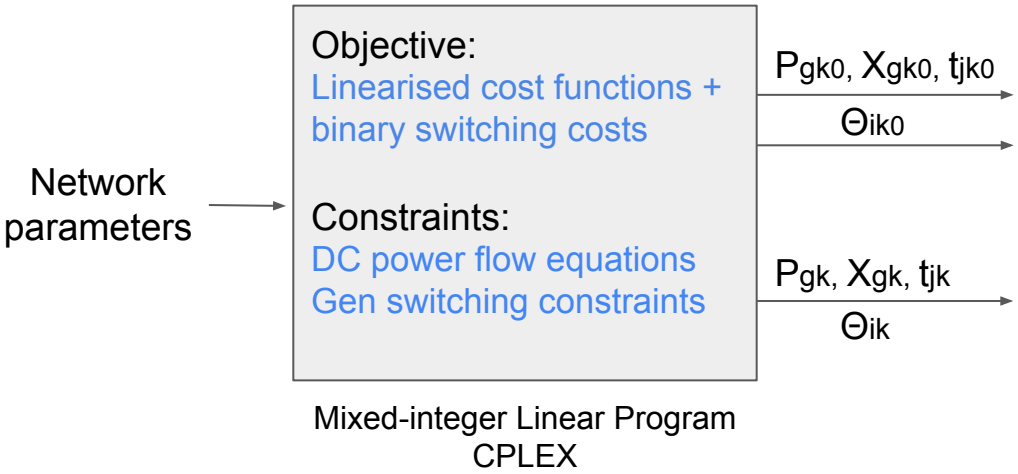
Core Approach

- Focus on speed for finding a feasible solution
- No parallelization of the preventative problem
    - Exploited multiple nodes for resiliency
- Selective simplifications of the problem formulation
- No integer rounding: MIP + NLP

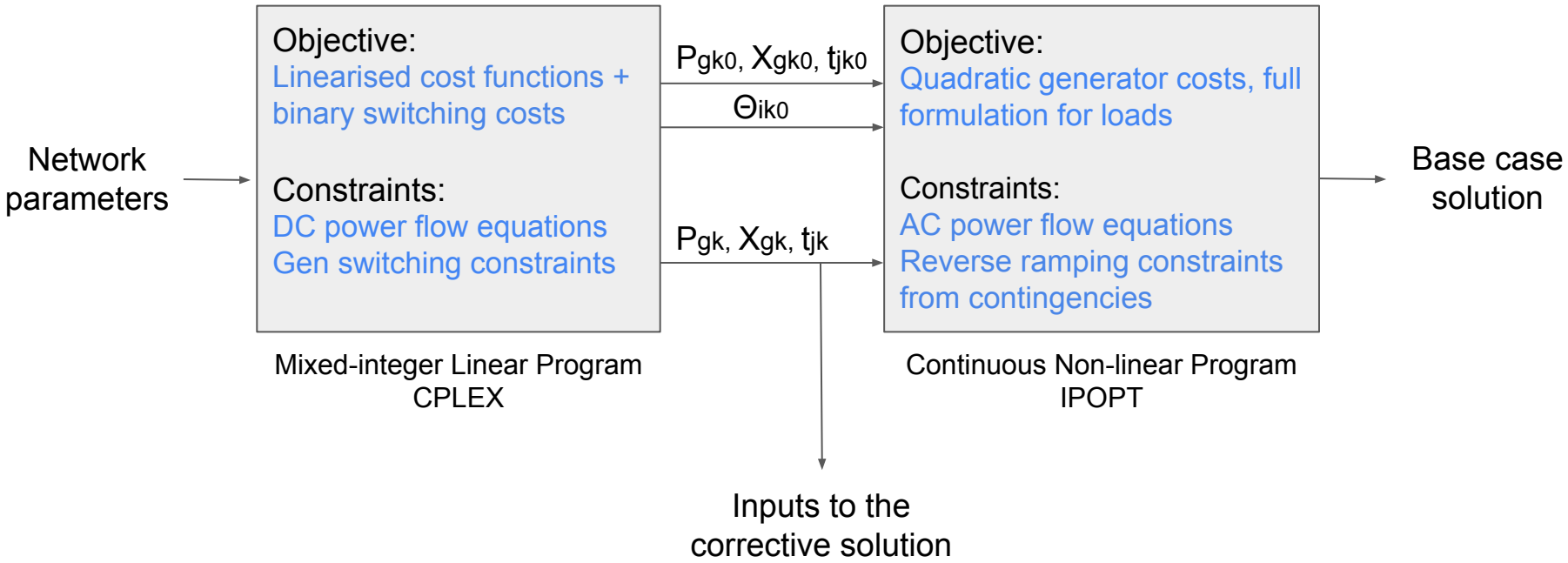
Computational details

- Code was written in Python
  - Added some overhead but sped up development
- We coupled two optimization problems:
  - Mixed integer linear program (CPLEX)
  - Continuous non-linear problem (IPOPT - cyipopt)
- Data read-in using functions provided in competition

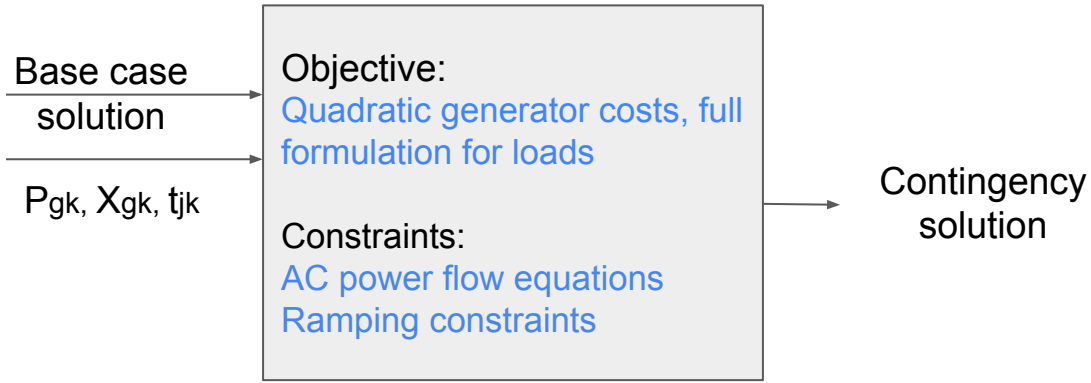
An Overview of our Method - Preventative SCOPF



An Overview of our Method - Preventative SCOPF

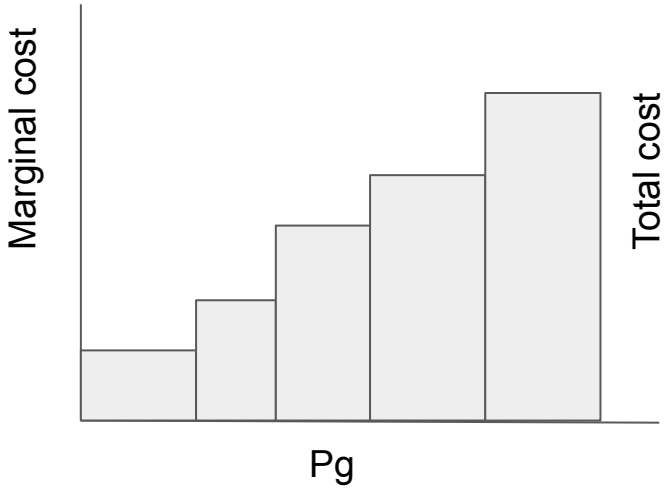


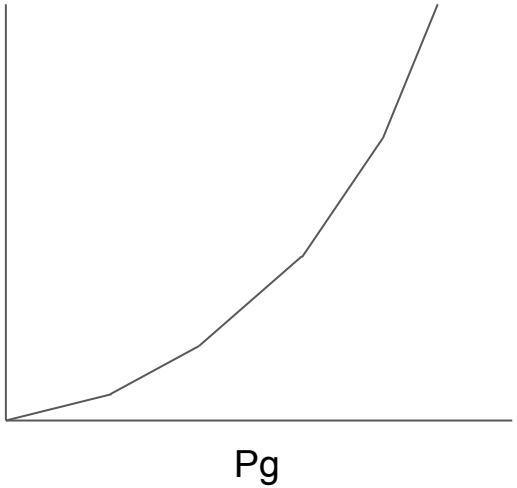
An Overview of our Method - Corrective SCOPF

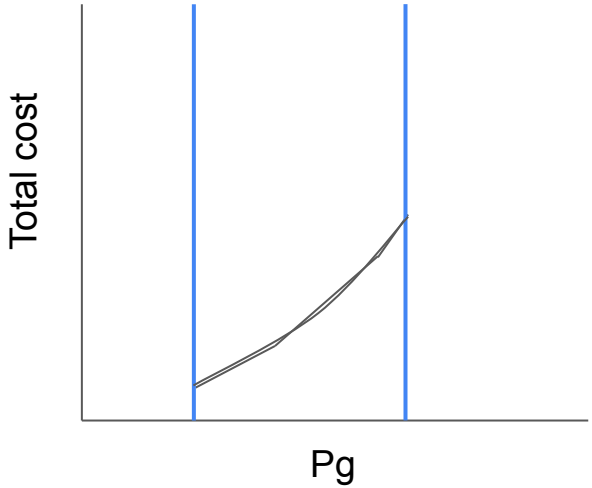


Simplification: Generator cost functions

- Quadratic approximation to generator costs





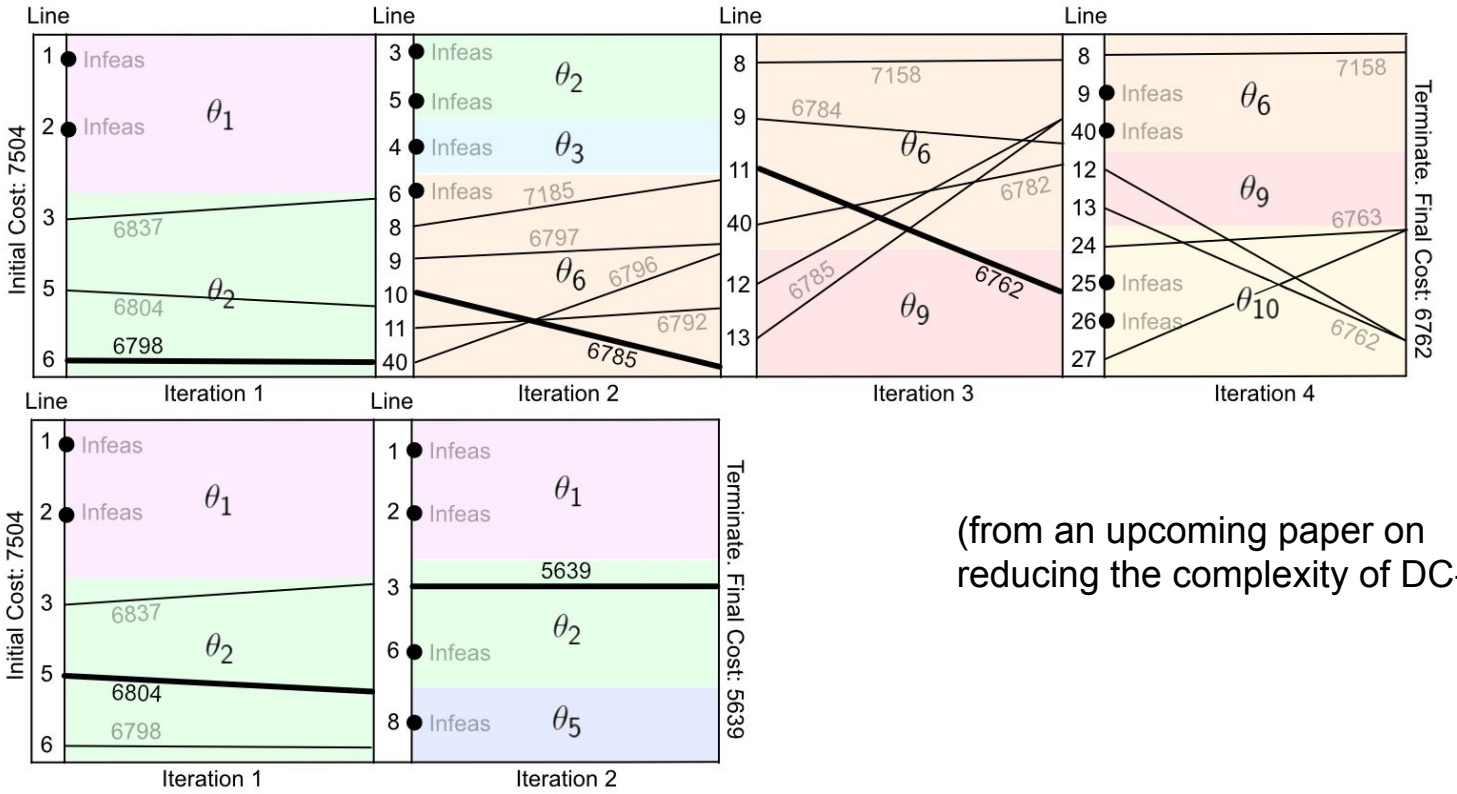


Simplification: Taps and Shunts

- Removed controllable shunts and transformer taps from the AC formulation
- Use of continuous variable relaxation sometimes back-fired

Score w/ varied taps and shunts	Score w/ fixed taps and shunts
65,091,360	65,333,260

Simplification: Removed line switching



(from an upcoming paper on reducing the complexity of DC-OTS)

Computational Speed Improvements

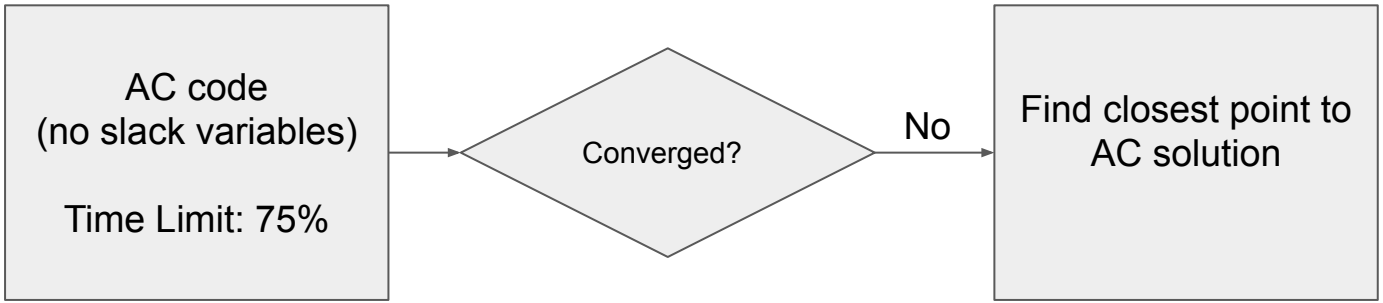
Derived analytic formulation of the Jacobian and Hessian

Calculated in vectorized form

```
class problem(object):

    def objective(self, x):
        # The callback for calculating the objective

    def gradient(self, x):
        # The callback for calculating the gradient

    def constraints(self, x):
        # The callback for calculating the constraints

    def jacobian(self, x):
        # The callback for calculating the Jacobian

    def hessian(self, x, lagrange, obj_factor):
        # The callback for calculating the Hessian
```

Computational Speed Improvements: Slack Variables

Try running AC code without slack variables first



Questions?