Enhanced Nested Decomposition Methods for Optimal Power Dispatching

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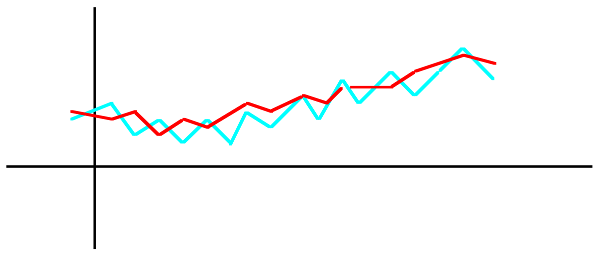


Outline

- Basic Problem
- General Nested Decomposition Method
- Enhancements
- Computational Results
- Unit Commitment Experience
- Summary

Basic Problem

- GOAL: Minimize the overall cost to meet power load over a given time horizon
- DECISIONS: Determine use of thermal units, releases of water over horizon
- RESTRICTIONS:
  - Must maintain load throughout entire horizon
  - Meet safety requirement
  - Ramping times, switching limits
  - Uncertain demand, supply, inflows

Power System Formulation

STOCHASTIC MODEL:

min $\sum_s p(s) \left(\sum_I \sum_T f_i(x(t,i,s), u(t,i,s)) \right)$

s.t. (for all s): $\Sigma_k\, x(t,i,s) \geq d(t), t=1..T$, $x(t,i,s)$ in $X(t,i,s,u)$

$y(t,i,s) = y(t-1,i,s) - r(i)\, x(t-1,i,s) + r(j)\, x(t-1,j,s) + flow(i,s)$

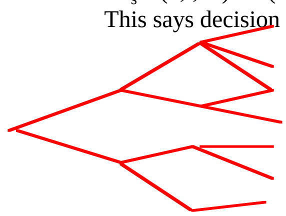
$x(t,i,s)$ limited over period by $y(t,i,s) \geq 0$,

$u(t,i,s)$ integer possible, $x(t,i,s) \geq 0$, all i,t;

Nonanticipativity:

$E_{s'}\, x(k,t,s') - x(k,t,s) = 0$ if $s',s \in S^t_i$ for all t, i, s

This says decision cannot depend on future.



Scenario Tree for possible s

General Method

- Generate rich set of spanning possible scenarios
- Decompose problem to nodes of scenario tree
- Solve each node iteratively
- Implementation: ND-UM

Summary

- Formulation as Stochastic Program
- Solution by Nested Decomposition ND-UM
- Enhancements with order of magnitude size/speed increases
- Lower level unit commitment solutions
- Multiple scenarios solved quickly