



Center for High Performance Power Electronics

Distribution Systems Research Focus

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Electrical and Computer Engineering
& Integrated Systems Engineering

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- Modern power system operation and planning
- Electricity markets, reconfiguration
- Demand side management
- Distributed generation and renewable energy

Research Interest

Power system analysis and planning

- Distribution and transmission system analysis
 - Analyzing impacts from *disruptive loads* on the grid
 - *Mobile loads*- Electric vehicles (level II and III charging) [p]
 - *Extreme sophisticated loads* – data center [p]
 - Incentive triggered loads- chaos demand response
 - Evaluating *grid service quality* and solutions
 - Voltage sagging and hilling in *radial feeder* systems
 - *Reactive power harvesting* with advance power electronics devices
 - Multi-objective reconfiguration and switching sequence management
 - Power quality improvement with Intelligence Electronics Devices (IED)

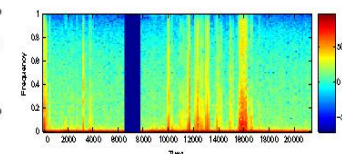
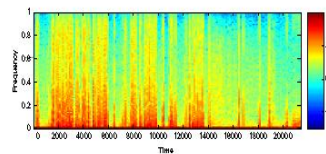
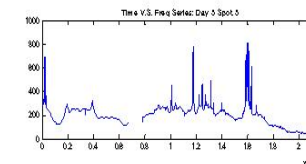
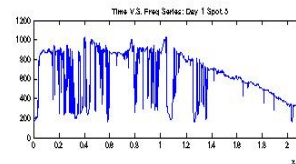
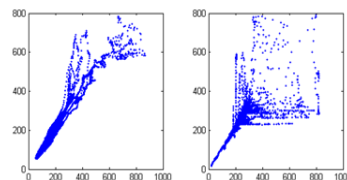
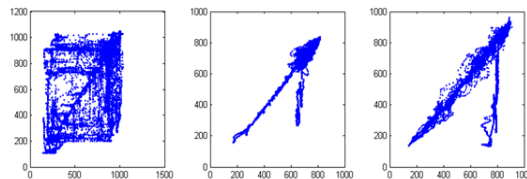
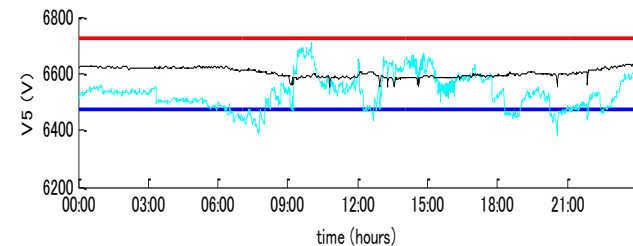
[p] proposal phase

- Distribution system planning
 - *Siting and sizing* of power delivery equipment
 - **Critical asset** identification and performance [p]
 - Capital investment postpone and equipment lifetime prolong with economic incentivized behaviors

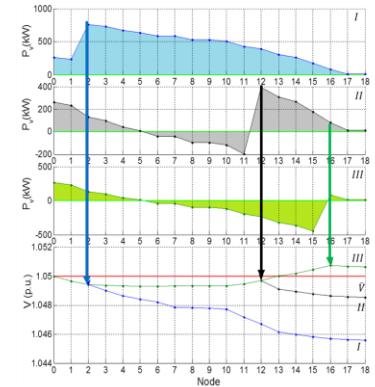
 - Optimizing *network layout* of distribution systems
 - Ecological network expansion [p]
 - Remote area connection
 - Integrated planning electric grid with other urban energy infrastructure [p]
 - Flexible network planning enabled by dynamic components

[p] proposal phase

- EV impact on radial distribution grid (OSU)
- EV battery insurance policy revisit – *considering engagement EV in electricity markets* (OSU)
- Grid Study (Energy Initiative, MIT)
- Advanced Metering Infrastructure (AMI) (MIT-Portugal)
- Solar power prediction (HRL, Japan)
- Step Voltage Regulation (SVR) (HRL, Japan)

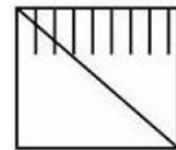
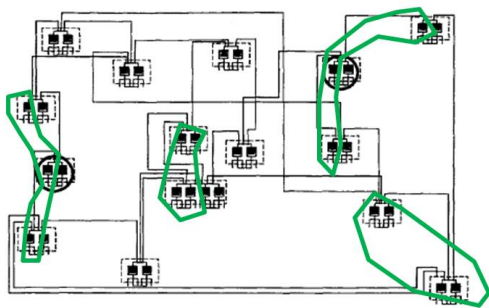


- Fast optimizing configuration of distributed generation in distribution system (MIT)
- Asset management in reconfigurable distribution systems (MIT)
- Flexible bidding mechanism in demand responsive wholesale energy market (MIT)
- Revising design principle of forward energy market integrated with renewable energy (MIT)

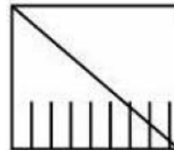


Voltage profiles of Feeder 1 induced from DG inserted at Node 2 (I), Node 12 (II), and Node 16 (III).

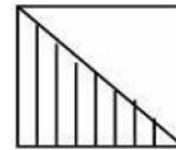
- Verified by **Dplan** Version 2.4 developed by IOA



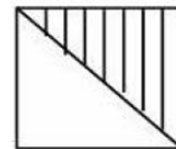
Early shifting



Late shifting



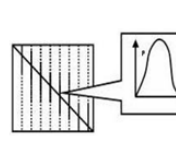
Forward shifting



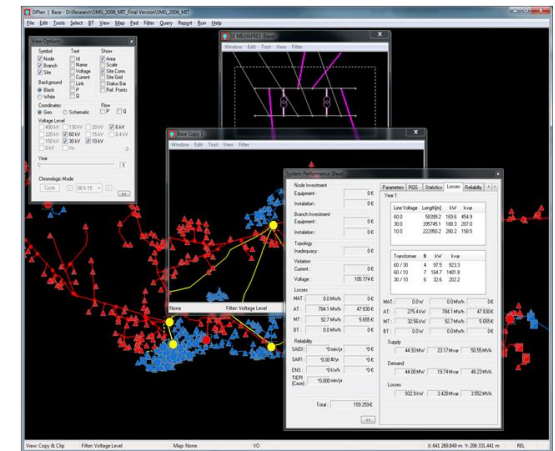
Backward shifting



Flexible



Real-world





Questions?