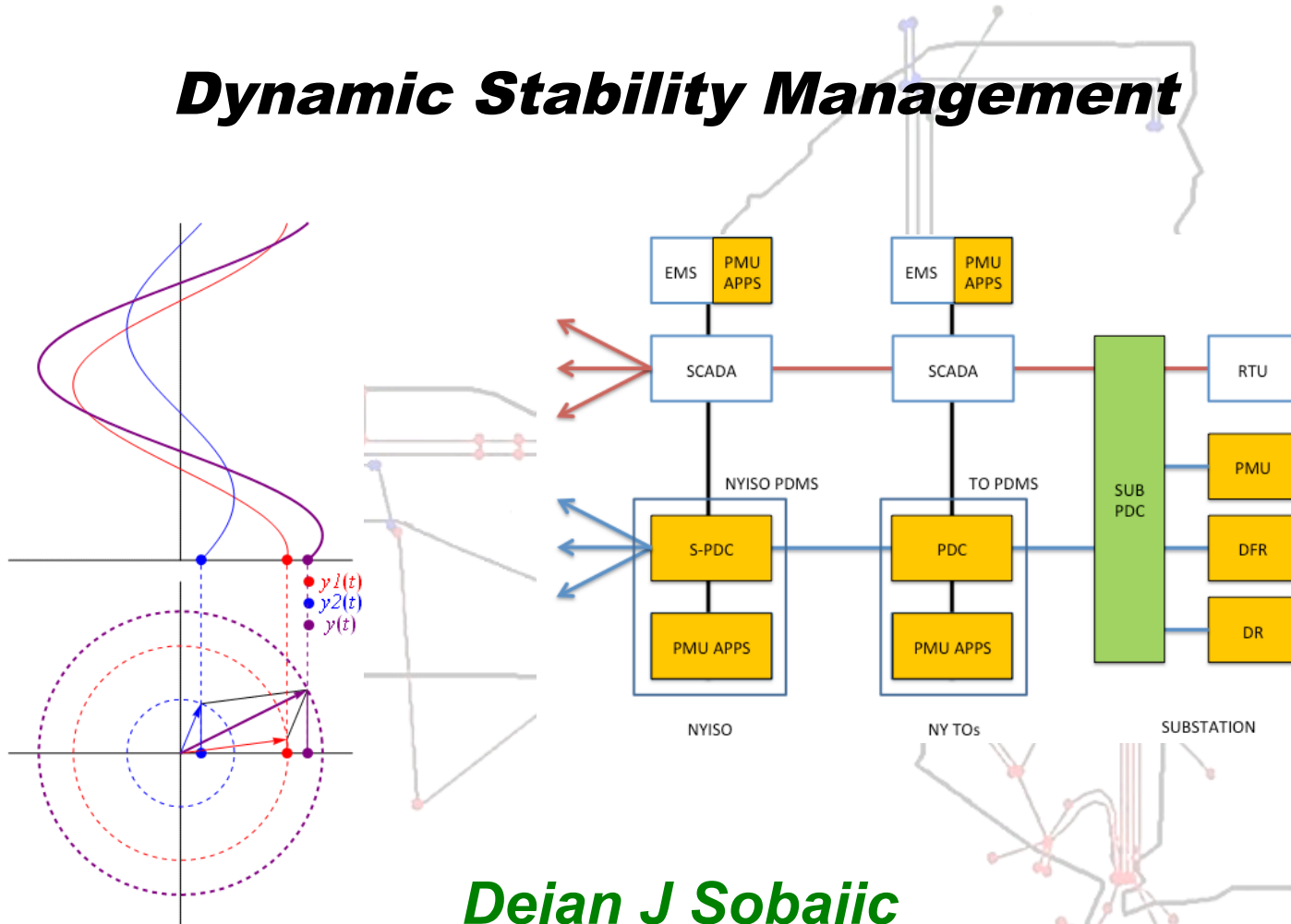


Dynamic Stability Management



Dejan J Sobajic
New York Independent System Operator

Electromagnetic Transients

Electromechanical Transients

Lightning

Line Switching

Subsynchronous Resonances

Transient Stability

Long Term Dynamics

Daily Load Following

DCV

OMS

VIZ

AGC

SE

VSM

CA1

CA2

DFR

PMU

RTU

10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻² 10⁻¹ 1s 10 10² 10³ 10⁴

1μs 1ms 6s 30s 1min 5min

30μs

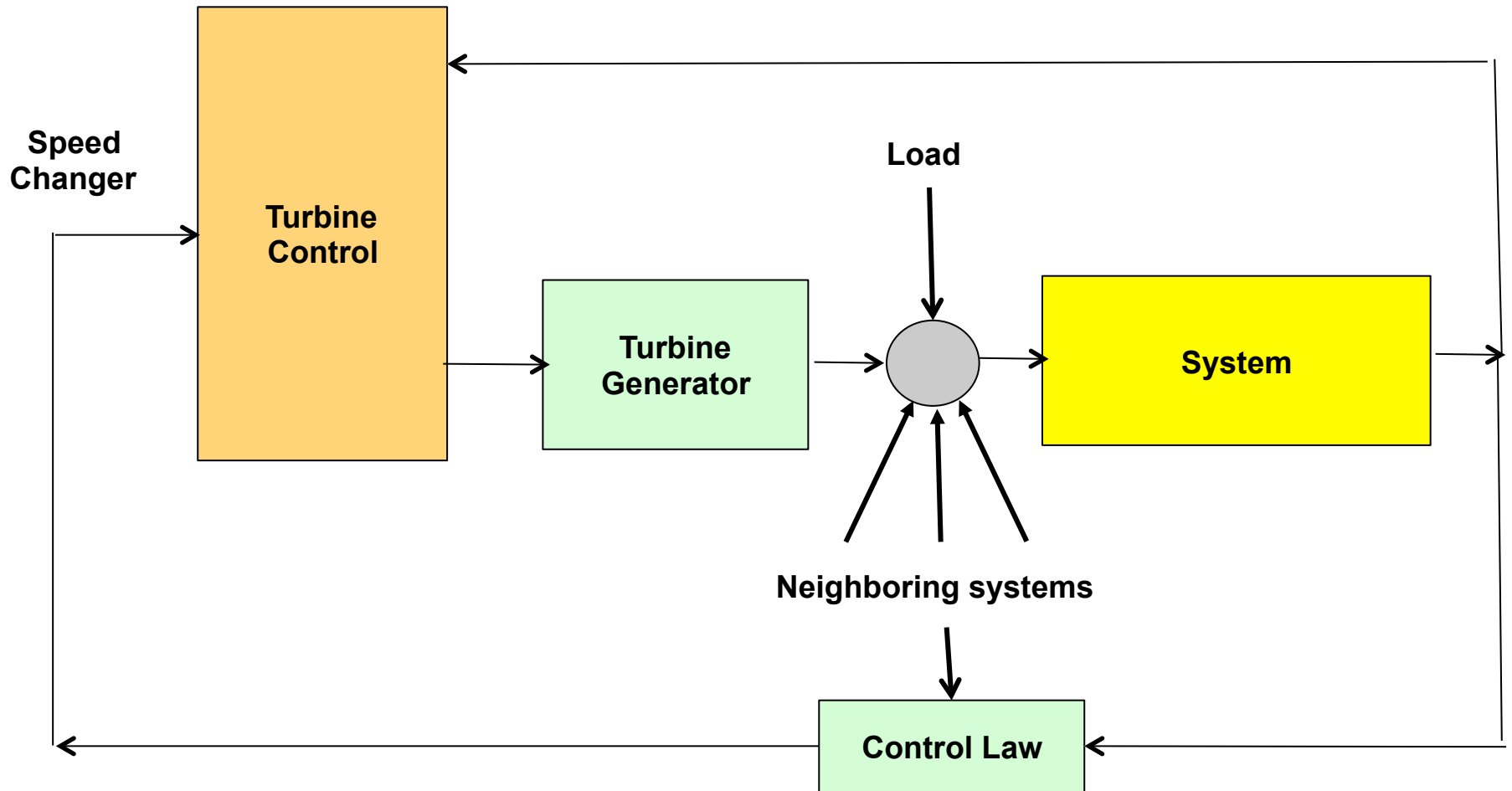
50-80ms

2-4sec

DATA ACQUISITION

Time Scale \ Source	Generator Driven	Load Driven
Short Term (ST)	<p>ROTOR ANGLE STABILITY</p> <ul style="list-style-type: none"> • Electromechanical Process (few seconds) • Modeling <ul style="list-style-type: none"> ○ Transient Dynamics (AVR, Excitation System, Turbine/Governor,..) • No Common Frequency <p>Low Frequency Oscillations Rotor Acceleration <i>Small Signal Stability</i> <i>Large Disturbances</i> Steady State Stability Transient Stability Lack of Damping Torque Lack of Synchronizing Torque System Linearization Nonlinear System Model</p> <ul style="list-style-type: none"> • Eigen-analysis 	<p>SHORT TERM VOLTAGE STABILITY</p> <ul style="list-style-type: none"> • Same model as Angular Stability involving <ul style="list-style-type: none"> ○ Load Dynamics ○ Drives ○ HVDC
Long Term (LT)	<p>FREQUENCY STABILITY</p> <ul style="list-style-type: none"> • Frequency Problems • Slow Dynamics • Generation/Load Imbalance • Islands with Common Frequency • Involves <ul style="list-style-type: none"> ○ Tap Changers ○ Generator Limiters ○ Boilers.... • Modeling -- Single bus with Generator and Load <p style="text-align: center;"><i>AGC</i></p>	<p>LONG TERM VOLTAGE STABILITY</p> <ul style="list-style-type: none"> • Generators, Load & Network involved • Full system model • Long Term → Steady State Analysis <p style="text-align: center;"><i>VOLTAGE COLLAPSE</i></p>

AGC Model Identification and Control

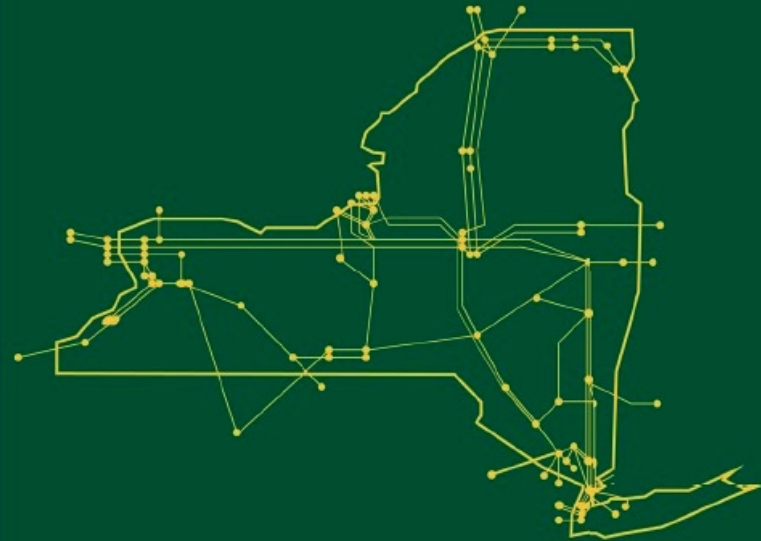


System Studies

- ◆ **Transfer Limits are regularly checked against thermal, voltage and stability violations**
- ◆ **Limits by interfaces with neighbors and zonal**
- ◆ **Not too many challenges in dynamic domain**
- ◆ **Some interarea oscillations (0.5 Hz) noticed in the past**
- ◆ **Around NYC very tight strong system**
- ◆ **PSS/E**

Thank You

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and conducts comprehensive planning for the state's bulk electricity system.



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