Texas A&M University, Department of Electrical Engineering, College Station, Texas, USA

Substation Data Integration & Information Exchange

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Project objective:

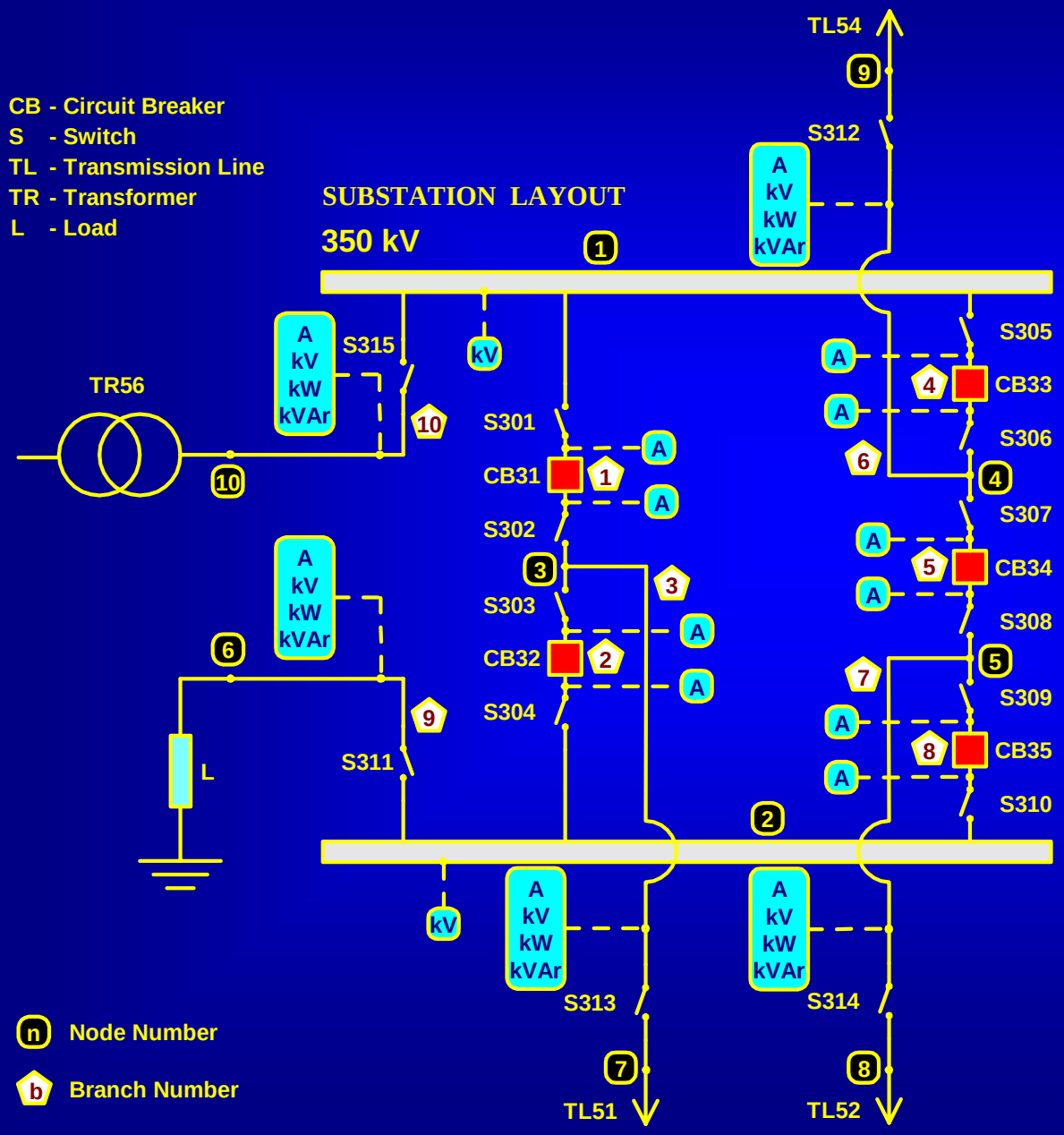
Utilize data obtained from Intelligent Electronic Devices (IEDs) to enhance Power System State Estimation

Research Approach

Concentrate on the following issues:

- Analyze digital relays and other Intelligent Electronic Devices installed in substations
- Explore modern trends in substation communications (IEC 61850)
- Collect data from various locations within substation and adjust the format
- Provide redundancy of measurements
- Write an application for data processing and consistency checking
- Communicate output to the higher level

Substation Layout - One Line Representation



Modeling Issues

Power Apparatus:

- Circuit Breakers
- Disconnect Switches
- Busbars
- Load - Reactor

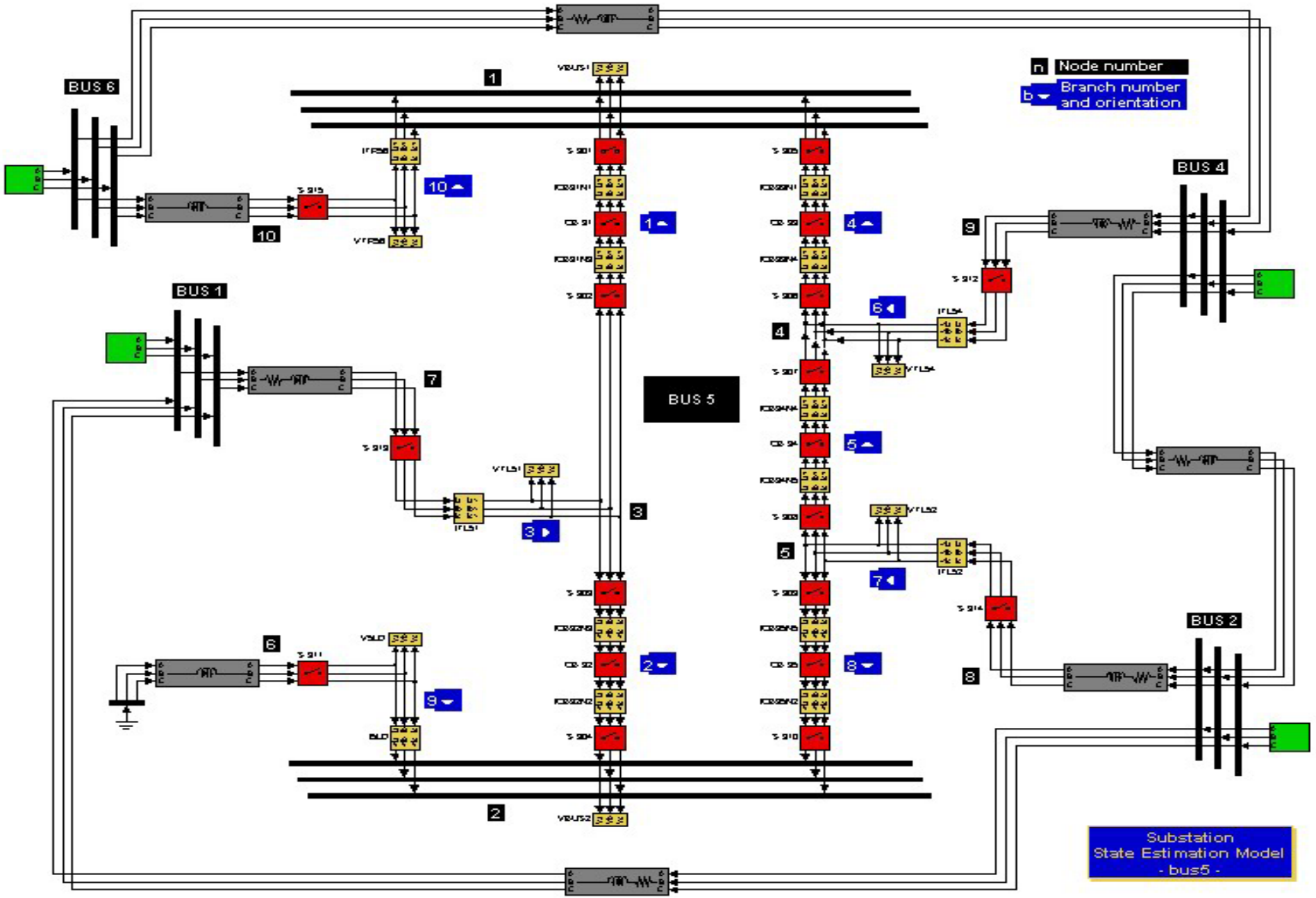
Analog Measurements:

- Currents [A]
- Voltages [kV]
- Power Flows [kW, kVAr]
- Power Injections [same]

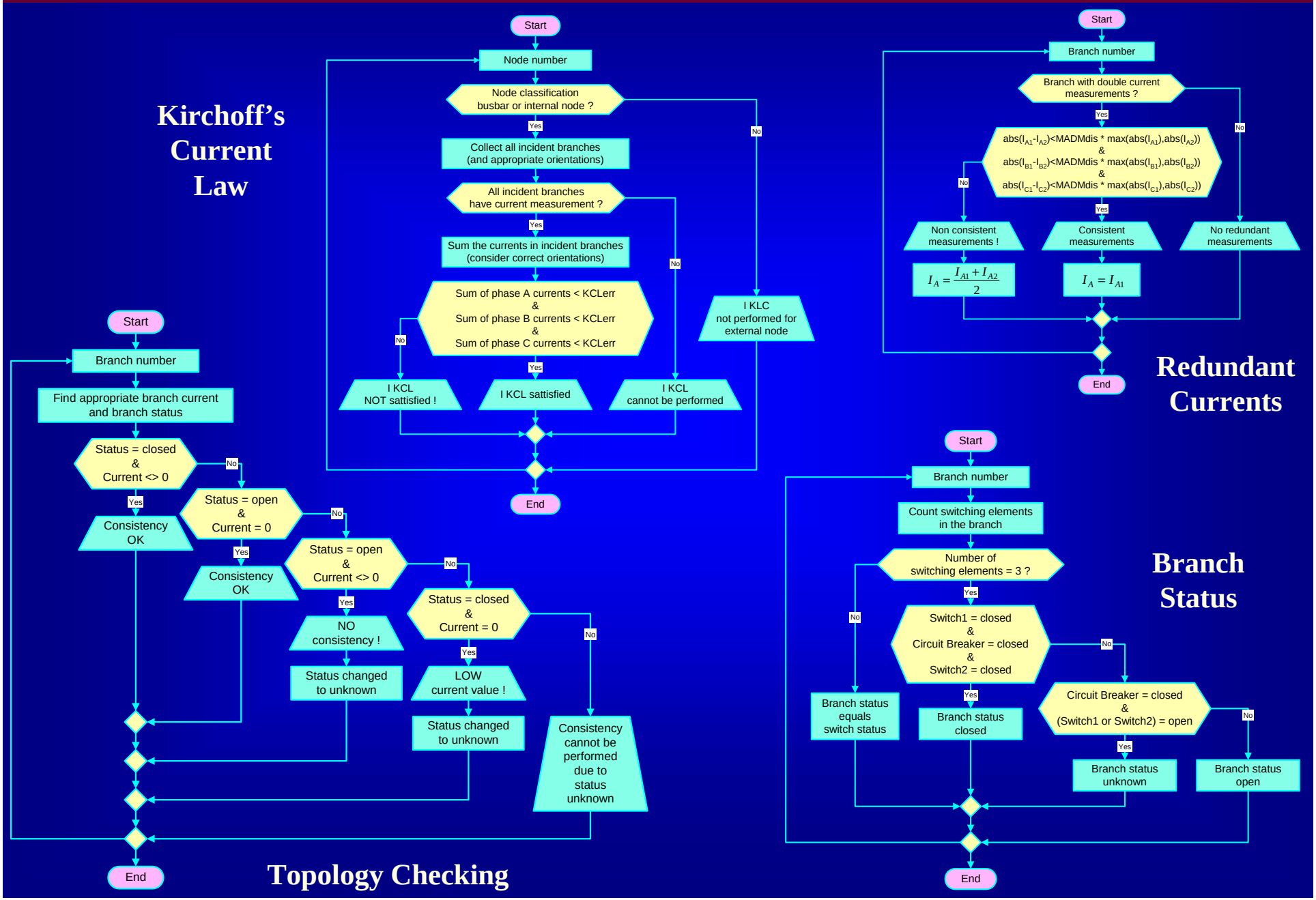
Digital Measurements:

- CB Statuses
- DS Statuses
- Ground Switches

Three-phase Substation Model in SIMULINK



Processing Algorithms in MATLAB



Project Results - Future Work

Output Tables

Communicated Data:

- Three-phase or single-phase output
- Possible errors filtered out
- More reliable data

Future Work:

- Substation transition analysis
- Switching sequences & interlocking
- State tracking & predicting
- Writing user friendly software

Node #	*1*	*2*	*3*	*4*	*5*	*…*
Voltage (mag)	0.99206	0.99206	0.99206	0.99206	0.99207	
Voltage (ang)	0.208	0.208	0.207	0.207	0.208	
Injection (act)	n/a	-0.0235	n/a	n/a	n/a	
Injection (react)	n/a	-0.9814	n/a	n/a	n/a	

Node Table

Branch #	*1*	*2*	*3*	*4*	*5*	*…*
Current (mag)	1.62494	1.02758	2.59226	1.42991	1.95869	
Current (ang)	176.539	-158.331	-173.769	179.742	-2.489	
Flow (act)	-	-	-2.55749	-	-3.35952	
Flow (react)	-	-	-0.26988	-	-0.10291	
Status	1	1	1	1	1	

Branch Table