Enhanced State Estimation by Advanced Substation Monitoring

Substation State Estimation (SSE) Software

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PSERC

PSerc Project Review Meeting

Texas A&M University

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Previous work has produced

PSERC

- Review of accuracy classes for measurement devices
- Classification of approaches to topology error detection
- Analysis of the substation model implementation
- Definition of measurement & consistency check algorithms
- Implementation of Three-phase simulation model (Substation SE Model)
- Specification of the interface between the system-wide SE the substation SE

Progress since the last review meeting and future work

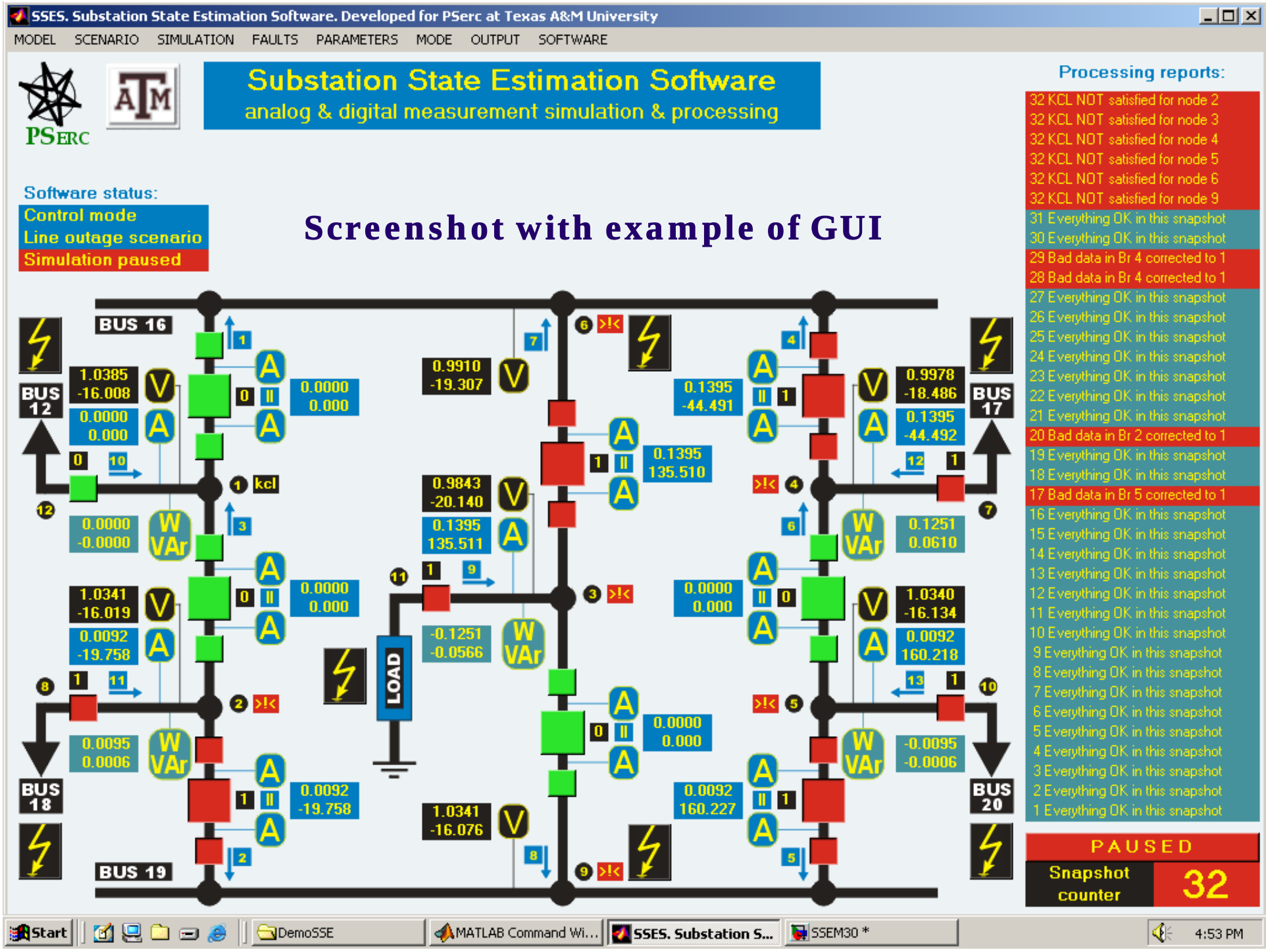
PSERC

- **Progress**
  - **Single-phase SIMULINK for Substation model is developed**
  - **MATLAB program is rewritten to support parallel simulation & processing**
  - **Two parts of the Substation State Estimation Software (SSES) were merged into one simulation/processing unit**
  - **Appropriate Graphical User Interface (GUI) was built**
  - **Substation control and bad data analysis modes are implemented**
  - **Communication with two stage State Estimation program was accomplished through the table exchange files**
- **Future work**
  - **Analyzing switching sequences & substation restoration**
  - **Developing substation state transition algorithms & incorporation into the SSE Software as a new mode of operation**

Substation State Estimation Software (SSES)

PSERC

- **Features**
  - **Control over the simulation execution and performance**
  - **Selection of Control or Bad Data mode**
  - **Selection of initial Bus-split or Line-outage scenario**
  - **Interactive status change of the switching element during simulation**
  - **Displaying the processed measurement quantities as values next to the corresponding instrument**
  - **Reporting the outcome of algorithm checks both as logical symbols and textual icons**
  - **Providing the history of snapshot reports during the simulation execution**
  - **Compact data output on the Graphical User Interface (GUI)**
  - **Generation of snapshot table communication files**


SSES. Substation State Estimation Software. Developed for PSerc at Texas A&M University
MODEL SCENARIO SIMULATION FAULTS PARAMETERS MODE OUTPUT SOFTWARE
PSERC
Substation State Estimation Software
analog & digital measurement simulation & processing
Software status:
Control mode
Line outage scenario
Simulation paused
Screenshot with example of GUI
Processing reports:
32 KCL NOT satisfied for node 2
32 KCL NOT satisfied for node 3
32 KCL NOT satisfied for node 4
32 KCL NOT satisfied for node 5
32 KCL NOT satisfied for node 6
32 KCL NOT satisfied for node 9
31 Everything OK in this snapshot
30 Everything OK in this snapshot
29 Bad data in Br 4 corrected to 1
28 Bad data in Br 4 corrected to 1
27 Everything OK in this snapshot
26 Everything OK in this snapshot
25 Everything OK in this snapshot
24 Everything OK in this snapshot
23 Everything OK in this snapshot
22 Everything OK in this snapshot
21 Everything OK in this snapshot
20 Bad data in Br 2 corrected to 1
19 Everything OK in this snapshot
18 Everything OK in this snapshot
17 Bad data in Br 5 corrected to 1
16 Everything OK in this snapshot
15 Everything OK in this snapshot
14 Everything OK in this snapshot
13 Everything OK in this snapshot
12 Everything OK in this snapshot
11 Everything OK in this snapshot
10 Everything OK in this snapshot
9 Everything OK in this snapshot
8 Everything OK in this snapshot
7 Everything OK in this snapshot
6 Everything OK in this snapshot
5 Everything OK in this snapshot
4 Everything OK in this snapshot
3 Everything OK in this snapshot
2 Everything OK in this snapshot
1 Everything OK in this snapshot
PAUSED
Snapshot counter
32
BUS 16
BUS 12
BUS 17
BUS 18
BUS 19
BUS 20
LOAD
1.0385 -16.008
0.0000 0.000
0.0000 0.000
0.0000 -0.0000
1.0341 -16.019
0.0092 -19.758
0.0095 0.0006
0.0092 -19.758
0.9910 -19.307
0.9843 -20.140
0.1395 135.511
-0.1251 -0.0566
1.0341 -16.076
0.1395 -44.491
0.1395 135.510
0.0000 0.000
0.0000 0.000
0.0092 160.227
0.9978 -18.486
0.1395 -44.492
0.1251 0.0610
1.0340 -16.134
0.0092 160.218
-0.0095 -0.0006
kcl
W VAr
Start
DemoSSE
MATLAB Command Wi...
SSES. Substation S...
SSEM30 *
4:53 PM