IEEE POWER ENGINEERING SOCIETY
Power System Analysis, Computing and Economics Committee

Chair
MARTIN L. BAUGHMAN
Professor Emeritus
The University of Texas at Austin
5703 Painted Valley Drive
Austin, TX 78759
Vox: 512-345-8255
Fax: 512-345-9880
baughman@mail.utexas.edu

Vice Chair
CHEN-CHING LIU
Dept. of Electrical Eng.
University of Washington
Box 352500
Seattle, WA 98195
Vox: 206-543-2198
Fax: 206-543-3842
liu@ee.washington.edu

Secretary
ROGER C. DUGAN
Sr. Consultant
Electrotek Concepts, Inc.
408 N Cedar Bluff Rd
Knoxville, TN 37923
Vox: 865-470-9222
Fax: 865-470-9223
r.dugan@ieee.org

Subcommittee Chairs

Computer & Analytical Methods
EDWIN LIU, Chair
Nexant, Inc.
101, 2nd street, 11F
San Francisco CA 94105
Vox: 415-369-1088
Fax: 415-369-0894
exliu@nexant.com

Distribution Systems Analysis
SANDOVAL CARNEIRO, JR, Chair
Dept. of Electrical Engineering
Federal Univ. of Rio de Janeiro
Rio de Janeiro, RJ, Brazil
Vox: 55-21-25628025
Fax: 55-21-25628628
sandoval@coep.ufrj.br

Intelligent System Applications
DAGMAR NIEBUR, Chair
Department of ECE
Drexel University
3141 Chestnut Street
Philadelphia, PA 19104
Vox: (215) 895 6749
Fax: (215) 895 1695
niebur@cbis.ece.drexel.edu

Reliability, Risk & Probability Applications
JAMES D. MCCALLEY, Chair
Iowa State University
Room 2210 Coover Hall
Ames, Iowa 50011
Vox: 515-294-4844
Fax: 515-294-4263
jdm@iastate.edu

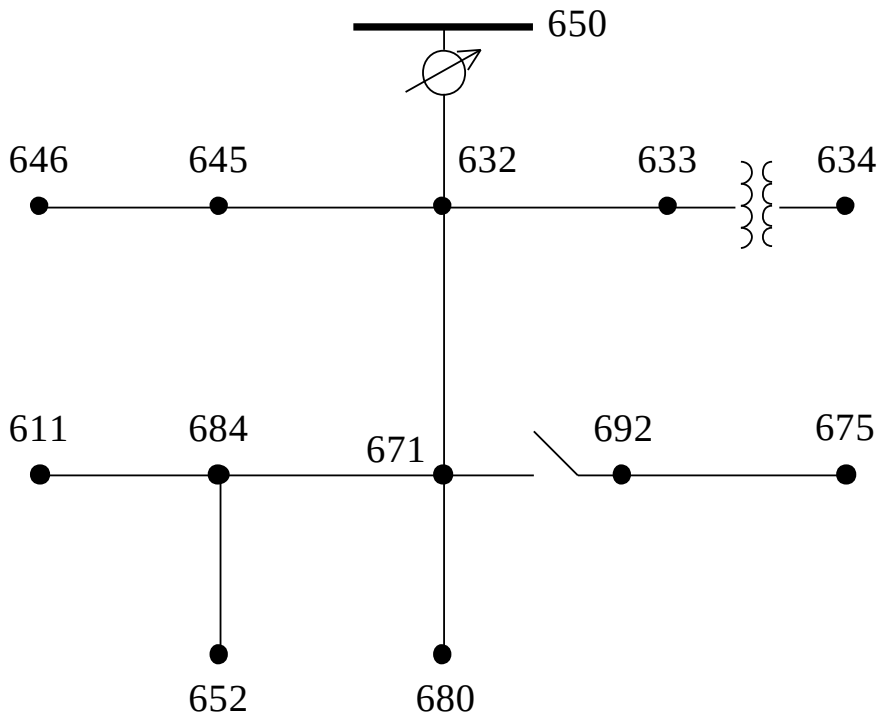
Systems Economics
ROSS BALDICK, Chair
ECE Dept. , ENS 502
The University of Texas at Austin
Austin, TX 78712
Vox: 512-471-5879
Fax: 512-471-5532
baldick@ece.utexas.edu

Past Chair
JOANN V. STARON
Nexant Inc/ PCA
1921 S. Alma School Road
Suite 207
Mesa, AZ 85210
Vox: 480-345-7600
Fax: 480-345-7601
joann.staron@pca-corp.com

Distribution System Analysis Subcommittee

IEEE 13 Node Test Feeder

IEEE 13 Node Test Feeder



Overhead Line Configuration Data:

Config.	Phasing	Phase	Neutral	Spacing
		ACSR	ACSR	ID
601	B A C N	556,500 26/7	4/0 6/1	500
602	C A B N	4/0 6/1	4/0 6/1	500
603	C B N	1/0	1/0	505
604	A C N	1/0	1/0	505
605	C N	1/0	1/0	510

Underground Line Configuration Data:

Config.	Phasing	Cable	Neutral	Space ID
606	A B C N	250,000 AA, CN	None	515
607	A N	1/0 AA, TS	1/0 Cu	520

Line Segment Data:

Node A	Node B	Length(ft.)	Config.
632	645	500	603
632	633	500	602
633	634	0	XFM-1
645	646	300	603
650	632	2000	601
684	652	800	607
632	671	2000	601
671	684	300	604
671	680	1000	601
671	692	0	Switch
684	611	300	605
692	675	500	606

Transformer Data:

	kVA	kV-high	kV-low	R - %	X - %
Substation:	5,000	115 - D	4.16 Gr. Y	1	8
XFM -1	500	4.16 – Gr.W	0.48 – Gr.W	1.1	2

Capacitor Data:

Node	Ph-A	Ph-B	Ph-C
	kVAr	kVAr	kVAr
675	200	200	200
611			100
Total	200	200	300

Regulator Data:

Regulator ID:	1		
Line Segment:	650 - 632		
Location:	50		
Phases:	A - B -C		
Connection:	3-Ph,LG		
Monitoring Phase:	A-B-C		
Bandwidth:	2.0 volts		
PT Ratio:	20		
Primary CT Rating:	700		
Compensator Settings:	Ph-A	Ph-B	Ph-C
R - Setting:	3	3	3
X - Setting:	9	9	9
Volltage Level:	122	122	122

Spot Load Data:

Node	Load	Ph-1	Ph-1	Ph-2	Ph-2	Ph-3	Ph-3
	Model	kW	kVAr	kW	kVAr	kW	kVAr
634	Y-PQ	160	110	120	90	120	90
645	Y-PQ	0	0	170	125	0	0
646	D-Z	0	0	230	132	0	0
652	Y-Z	128	86	0	0	0	0
671	D-PQ	385	220	385	220	385	220
675	Y-PQ	485	190	68	60	290	212
692	D-I	0	0	0	0	170	151
611	Y-I	0	0	0	0	170	80
	TOTAL	1158	606	973	627	1135	753

Distributed Load Data:

Node A	Node B	Load	Ph-1	Ph-1	Ph-2	Ph-2	Ph-3	Ph-3
		Model	kW	kVAr	kW	kVAr	kW	kVAr
632	671	Y-PQ	17	10	66	38	117	68

IEEE 13 NODE TEST FEEDER

Impedances

Configuration 601:

```
           Z (R +jX) in ohms per mile
 0.3465  1.0179   0.1560  0.5017   0.1580  0.4236
                  0.3375  1.0478   0.1535  0.3849
                                   0.3414  1.0348
          B in micro Siemens per mile
            6.2998   -1.9958   -1.2595
                      5.9597   -0.7417
                                5.6386
```

Configuration 602:

```
           Z (R +jX) in ohms per mile
0.7526  1.1814   0.1580  0.4236   0.1560  0.5017
                 0.7475  1.1983   0.1535  0.3849
                                  0.7436  1.2112
         B in micro Siemens per mile
           5.6990   -1.0817   -1.6905
                     5.1795   -0.6588
                               5.4246
```

Configuration 603:

```
           Z (R +jX) in ohms per mile
 0.0000  0.0000   0.0000  0.0000   0.0000  0.0000
                  1.3294  1.3471   0.2066  0.4591
                                   1.3238  1.3569
          B in micro Siemens per mile
            0.0000    0.0000    0.0000
                      4.7097   -0.8999
                                4.6658
```

Configuration 604:

```
           Z (R +jX) in ohms per mile
 1.3238  1.3569   0.0000  0.0000   0.2066  0.4591
                  0.0000  0.0000   0.0000  0.0000
                                   1.3294  1.3471
          B in micro Siemens per mile
            4.6658    0.0000   -0.8999
                      0.0000    0.0000
                                4.7097
```

Configuration 605:

```
            Z (R +jX) in ohms per mile
 0.0000  0.0000   0.0000  0.0000   0.0000  0.0000
                  0.0000  0.0000   0.0000  0.0000
                                   1.3292  1.3475
           B in micro Siemens per mile
             0.0000    0.0000    0.0000
                       0.0000    0.0000
                                 4.5193
```

Configuration 606:

```
            Z (R +jX) in ohms per mile
0.7982  0.4463   0.3192  0.0328   0.2849 -0.0143
                 0.7891  0.4041   0.3192  0.0328
                                  0.7982  0.4463
          B in micro Siemens per mile
           96.8897    0.0000    0.0000
                     96.8897    0.0000
                               96.8897
```

Configuration 607:

```
            Z (R +jX) in ohms per mile
 1.3425  0.5124   0.0000  0.0000   0.0000  0.0000
                  0.0000  0.0000   0.0000  0.0000
                                   0.0000  0.0000
           B in micro Siemens per mile
            88.9912    0.0000    0.0000
                       0.0000    0.0000
                                 0.0000
```

Power-Flow Results

- **R A D I A L F L O W S U M M A R Y** - DATE: 6-24-2004 AT 15:33: 2 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

SYSTEM INPUT	PHASE (A)	PHASE (B)	PHASE (C)	TOTAL
kW :	1251.398	977.332	1348.461	3577.191
kVAr :	681.570	373.418	669.784	1724.772
kVA :	1424.968	1046.241	1505.642	3971.289
PF :	.8782	.9341	.8956	.9008

LOAD	(A-N)	(A-B)	(B-N)	(B-C)	(C-N)	(C-A)	WYE	DELTA
kW :	785.6	385.0	424.0	625.7	692.5	553.4	1902.1	1564.0
TOT :	1170.563		1049.658		1245.907		3466.128	
kVAr :	393.0	220.0	313.0	358.1	447.9	369.5	1153.9	947.7
TOT :	613.019		671.117		817.450		2101.586	
kVA :	878.4	443.4	527.0	720.9	824.8	665.4	2224.8	1828.7
TOT :	1321.367		1245.865		1490.137		4053.481	
PF :	.8943	.8682	.8045	.8679	.8397	.8316	.8550	.8553
TOT :	.8859		.8425		.8361		.8551	

LOSSES	(A)	(B)	(C)	TOTAL
kW :	39.107	-4.697	76.653	111.063
kVAr :	152.585	42.217	129.850	324.653
kVA :	157.517	42.478	150.787	343.124

CAPAC	(A-N)	(A-B)	(B-N)	(B-C)	(C-N)	(C-A)	WYE	DELTA
R-kVA:	200.0	.0	200.0	.0	300.0	.0	700.0	.0
TOT :	200.000		200.000		300.000		700.000	
A-kVA:	193.4	.0	222.7	.0	285.3	.0	701.5	.0
TOT :	193.443		222.747		285.276		701.466	

--- **V O L T A G E P R O F I L E** ---- DATE: 6-24-2004 AT 15:33:12 HOURS ----
SUBSTATION: IEEE 13; FEEDER: IEEE 13

NODE	MAG	ANGLE	MAG	ANGLE	MAG	ANGLE	mi.to SR
	A-N		B-N		C-N		
650	1.0000 at	.00	1.0000 at	-120.00	1.0000 at	120.00	.000
RG60	1.0625 at	.00	1.0500 at	-120.00	1.0687 at	120.00	.000
632	1.0210 at	-2.49	1.0420 at	-121.72	1.0174 at	117.83	.379
633	1.0180 at	-2.56	1.0401 at	-121.77	1.0148 at	117.82	.474
XFXFM1	.9941 at	-3.23	1.0218 at	-122.22	.9960 at	117.35	.474
634	.9940 at	-3.23	1.0218 at	-122.22	.9960 at	117.34	.474
645			1.0329 at	-121.90	1.0155 at	117.86	.474
646			1.0311 at	-121.98	1.0134 at	117.90	.530
671	.9900 at	-5.30	1.0529 at	-122.34	.9778 at	116.02	.758
680	.9900 at	-5.30	1.0529 at	-122.34	.9778 at	116.02	.947
684	.9881 at	-5.32			.9758 at	115.92	.815
611					.9738 at	115.78	.871
652	.9825 at	-5.25					.966
692	.9900 at	-5.31	1.0529 at	-122.34	.9777 at	116.02	.852
675	.9835 at	-5.56	1.0553 at	-122.52	.9758 at	116.03	.947

---------- **VOLTAGE REGULATOR DATA** ---- DATE: 6-24-2004 AT 15:33:16 HOURS --
SUBSTATION: IEEE 13; FEEDER: IEEE 13

[NODE]	[VREG]	[SEG]	[NODE]	MODEL	OPT	BNDW
650	RG60	632	632	Phase A & B & C, Wye	RX	2.00

PHASE	LDCTR	VOLT HOLD	R-VOLT	X-VOLT	PT RATIO	CT RATE	TAP
1		122.000	3.000	9.000	20.00	700.00	10
2		122.000	3.000	9.000	20.00	700.00	8
3		122.000	3.000	9.000	20.00	700.00	11

- **R A D I A L P O W E R F L O W** --- DATE: 6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

```
   NODE      VALUE          PHASE A          PHASE B          PHASE C     UNT O/L<
                             (LINE A)         (LINE B)         (LINE C)        60.%
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 650       VOLTS:   1.000     .00   1.000 -120.00   1.000  120.00 MAG/ANG
kVll   4.160           NO LOAD OR CAPACITOR REPRESENTED AT SOURCE NODE

TO NODE RG60  <VRG>..:  593.30  -28.58  435.61 -140.91  626.92   93.59 AMP/DG <
<RG60  > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: RG60      VOLTS:   1.062     .00   1.050 -120.00   1.069  120.00 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE 650   <VRG>:  558.40  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<RG60  > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
TO NODE 632   .......:  558.40  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<632   > LOSS= 59.716:    ( 21.517)       ( -3.252)       ( 41.451)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 632       VOLTS:   1.021   -2.49   1.042 -121.72   1.017  117.83 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE RG60  .....:  558.41  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<632   > LOSS= 59.716:    ( 21.517)       ( -3.252)       ( 41.451)    kW
TO NODE 633   .......:   81.33  -37.74   61.12 -159.09   62.70   80.48 AMP/DG
<633   > LOSS=   .808:    (   .354)       (   .148)       (   .306)    kW
TO NODE 645   .......:                   143.02 -142.66   65.21   57.83 AMP/DG <
<645   > LOSS=  2.760:                     (  2.540)       (   .220)    kW
TO NODE 671   .......:  478.29  -27.03  215.12 -134.66  475.50   99.90 AMP/DG <
<671   > LOSS= 35.897:    ( 10.484)       ( -6.169)       ( 31.582)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 633       VOLTS:   1.018   -2.56   1.040 -121.77   1.015  117.82 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE 632   .....:   81.33  -37.74   61.12 -159.09   62.71   80.47 AMP/DG
<633   > LOSS=   .808:    (   .354)       (   .148)       (   .306)    kW
TO NODE XFXFM1.......:   81.33  -37.74   61.12 -159.09   62.71   80.47 AMP/DG <
<XFXFM1> LOSS=  5.427:    (  2.513)       (  1.420)       (  1.494)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: XFXFM1    VOLTS:    .994   -3.23   1.022 -122.22    .996  117.35 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll    .480      CAP:             .00             .00             .00 kVR

FROM NODE 633   .....:  704.83  -37.74  529.73 -159.09  543.45   80.47 AMP/DG <
<XFXFM1> LOSS=  5.427:    (  2.513)       (  1.420)       (  1.494)    kW
TO NODE 634   .......:  704.83  -37.74  529.73 -159.09  543.45   80.47 AMP/DG <
<634   > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
```

- **R A D I A L P O W E R F L O W** --- DATE: 6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

NODE	VALUE	PHASE A (LINE A)		PHASE B (LINE B)		PHASE C (LINE C)		UNT	O/L< 60.%
NODE: 634	VOLTS:	.994	-3.23	1.022	-122.22	.996	117.34	MAG/ANG	
	Y-LD:	160.00	110.00	120.00	90.00	120.00	90.00	kW/kVR	
kVll .480	Y CAP:		.00		.00		.00	kVR	
FROM NODE XFXFM1.....:		704.83	-37.74	529.73	-159.09	543.45	80.47	AMP/DG	<
<634 > LOSS= .000:		(.000)		(.000)		(.000)		kW	
NODE: 645	VOLTS:			1.033	-121.90	1.015	117.86	MAG/ANG	
	Y-LD:			170.00	125.00	.00	.00	kW/kVR	
kVll 4.160	Y CAP:				.00		.00	kVR	
FROM NODE 632 .....:				143.02	-142.66	65.21	57.83	AMP/DG	<
<645 > LOSS= 2.760:				(2.540)		(.220)		kW	
TO NODE 646 .....:				65.21	-122.17	65.21	57.83	AMP/DG	
<646 > LOSS= .541:				(.271)		(.270)		kW	
NODE: 646	VOLTS:			1.031	-121.98	1.013	117.90	MAG/ANG	
	D-LD:			240.66	138.12	.00	.00	kW/kVR	
kVll 4.160	Y CAP:				.00		.00	kVR	
FROM NODE 645 .....:				65.21	-122.18	65.21	57.82	AMP/DG	
<646 > LOSS= .541:				(.271)		(.270)		kW	
NODE: 671	VOLTS:	.990	-5.30	1.053	-122.34	.978	116.02	MAG/ANG	
	D-LD:	385.00	220.00	385.00	220.00	385.00	220.00	kW/kVR	
kVll 4.160	Y CAP:		.00		.00		.00	kVR	
FROM NODE 632 .....:		470.20	-26.90	186.41	-131.89	420.64	101.66	AMP/DG	<
<671 > LOSS= 35.897:		(10.484)		(-6.169)		(31.582)		kW	
TO NODE 680 .....:		.00	.00	.00	.00	.00	.00	AMP/DG	
<680 > LOSS= .000:		(-.001)		(.001)		(.000)		kW	
TO NODE 684 .....:		63.07	-39.12			71.15	121.62	AMP/DG	
<684 > LOSS= .580:		(.210)				(.370)		kW	
TO NODE 692 .....:		229.11	-18.18	69.61	-55.19	178.38	109.39	AMP/DG	
<692 > LOSS= .008:		(.003)		(-.001)		(.006)		kW	
NODE: 680	VOLTS:	.990	-5.30	1.053	-122.34	.978	116.02	MAG/ANG	
	-LD:	.00	.00	.00	.00	.00	.00	kW/kVR	
kVll 4.160	CAP:		.00		.00		.00	kVR	
FROM NODE 671 .....:		.00	.00	.00	.00	.00	.00	AMP/DG	
<680 > LOSS= .000:		(-.001)		(.001)		(.000)		kW	

- **R A D I A L P O W E R F L O W** --- DATE: 6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

NODE	VALUE	PHASE A (LINE A)	PHASE B (LINE B)	PHASE C (LINE C)	UNT O/L< 60.%
NODE: 684	VOLTS:	.988 -5.32		.976 115.92	MAG/ANG
	-LD:	.00 .00		.00 .00	kW/kVR
kVll 4.160	CAP:	.00		.00	kVR
FROM NODE 671	:	63.07 -39.12		71.15 121.61	AMP/DG
<684 > LOSS= .580	:	(.210)		(.370)	kW
TO NODE 611	:			71.15 121.61	AMP/DG
<611 > LOSS= .382	:			(.382)	kW
TO NODE 652	:	63.07 -39.12			AMP/DG
<652 > LOSS= .808	:	(.808)			kW
NODE: 611	VOLTS:			.974 115.78	MAG/ANG
	Y-LD:			165.54 77.90	kW/kVR
kVLL 4.160	Y CAP:			94.82	kVR
FROM NODE 684	:			71.15 121.61	AMP/DG
<611 > LOSS= .382	:			(.382)	kW
NODE: 652	VOLTS:	.983 -5.25			MAG/ANG
	Y-LD:	123.56 83.02			kW/kVR
kVll 4.160	Y CAP:	.00			kVR
FROM NODE 684	:	63.08 -39.15			AMP/DG
<652 > LOSS= .808	:	(.808)			kW
NODE: 692	VOLTS:	.990 -5.31	1.053 -122.34	.978 116.02	MAG/ANG
	D-LD:	.00 .00	.00 .00	168.37 149.55	kW/kVR
kVll 4.160	Y CAP:	.00	.00	.00	kVR
FROM NODE 671	:	229.11 -18.18	69.61 -55.19	178.38 109.39	AMP/DG
<692 > LOSS= .008	:	(.003)	(-.001)	(.006)	kW
TO NODE 675	:	205.33 -5.15	69.61 -55.19	124.07 111.79	AMP/DG <
<675 > LOSS= 4.136	:	(3.218)	(.345)	(.573)	kW
NODE: 675	VOLTS:	.983 -5.56	1.055 -122.52	.976 116.03	MAG/ANG
	Y-LD:	485.00 190.00	68.00 60.00	290.00 212.00	kW/kVR
kVll 4.160	Y CAP:	193.44	222.75	190.45	kVR
FROM NODE 692	:	205.33 -5.15	69.59 -55.20	124.07 111.78	AMP/DG <
<675 > LOSS= 4.136	:	(3.218)	(.345)	(.573)	kW