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LAMPIRAN A

DATA PENGAMATAN TAHUN 1999

a. Data pengamatan sudut tahun 1999 (diukur menggunakan Sokkisha TM1A dengan ketelitian alat 1")

Titik Berdiri Alat	Target	Ukuran Sudut			
		Derajat	Menit	Sekon	Derajat Desimal
S1	S2	137	57	42	137,9616667
	S8				
S2	S1	116	54	58	116,9161111
	S3				
S3	S2	166	20	08	166,3355556
	S4				
S4	S3	116	32	28	116,5411111
	S5				
S5	S4	139	01	17	139,0213889
	S6				
S6	S5	119	25	43	119,4286111
	S7				
S7	S6	166	59	31	166,9919444
	S8				
S8	S7	116	48	13	116,8036111
	S1				

b. Data pengamatan jarak tahun 1999 (diukur menggunakan pita ukur dengan ketelitian alat 1 mm)

Titik Berdiri Alat	Target	Ukuran Jarak (m)
S1	S2	23,489
S2	S3	22,800
S3	S4	21,580
S4	S5	23,365
S5	S6	22,908
S6	S7	20,840
S7	S8	22,195
S8	S1	23,954

LAMPIRAN B

DATA PENGAMATAN TAHUN 2001

a. Data pengamatan sudut tahun 2001 (diukur menggunakan Sokkisha TM1A dengan ketelitian alat 1")

Titik Berdiri Alat	**Target**	**Ukuran Sudut**			
		Derajat	**Menit**	**Sekon**	**Derajat Desimal**
S1	S2	137	58	22	137,9727778
	S8				
S2	S1	116	54	57	116,9158333
	S3				
S3	S2	166	20	19	166,3386111
	S4				
S4	S3	116	31	36	116,5266667
	S5				
S5	S4	139	00	58	139,0161111
	S6				
S6	S5	119	26	25	119,4402778
	S7				
S7	S6	167	00	48	167,0133333
	S8				
S8	S7	116	46	35	116,7763889
	S1				

b. Data pengamatan jarak tahun 2001 (diukur menggunakan pita ukur dengan ketelitian alat 1 mm)

Titik Berdiri Alat	Target	Ukuran Jarak (m)
S1	S2	23,490
S2	S3	22,800
S3	S4	21,585
S4	S5	23,368
S5	S6	22,910
S6	S7	20,842
S7	S8	22,196
S8	S1	23,958

LAMPIRAN C

DATA PENGAMATAN TAHUN 2011

a. Data pengamatan sudut tahun 2011

Titik Berdiri Alat	Target	Ukuran Sudut		
		Derajat	Menit	Sekon
S1	S2	137	57	06
	S8			
S2	S1	116	01	12
	S3			
S3	S2	166	31	17
	S4			
S4	S3	112	53	24
	S5			
S5	S4	143	23	48
	S6			
S6	S5	119	26	10
	S7			
S7	S6	166	58	51
	S8			
S8	S7	116	48	12
	S1			

b. Data pengamatan jarak tahun 2001 (diukur menggunakan pita ukur dengan ketelitian alat 1 mm)

Titik Berdiri Alat	Target	Ukuran Jarak (m)
S1	S2	23,489
S2	S3	22,643
S3	S4	23,854
S4	S5	21,842
S5	S6	22,910
S6	S7	20,838
S7	S8	22,195
S8	S1	23,957

LAMPIRAN D

DATA PENGAMATAN TAHUN 2013

a. Data pengamatan sudut tahun 2013 (diukur menggunakan Nikon DTM-352 dengan ketelitian alat 5")

Titik Berdiri Alat	**Target**	**Ukuran Sudut I**			**Ukuran Sudut II**			**Ukuran Sudut III**			**Ukuran Sudut IV**		
		Derajat	**Menit**	**Sekon**	**Derajat**	**Menit**	**Sekon**	**Derajat**	**Menit**	**Sekon**	**Derajat**	**Menit**	**Sekon**
S1	S2	137	57	47	137	57	7	137	57	19	137	57	42
	S8												
S2	S1	116	2	31	116	2	8	116	2	36	116	1	48
	S3												
S3	S2	166	29	53	166	30	5	166	30	3	166	30	0
	S4												
S4	S3	112	54	9	112	53	54	112	54	3	112	53	57
	S5												
S5	S4	143	23	10	143	23	26	143	23	48	143	23	29
	S6												
S6	S5	119	26	22	119	26	12	119	26	20	119	26	14
	S7												
S7	S6	166	58	55	166	58	58	166	58	53	166	58	52
	S8												
S8	S7	116	47	45	116	48	22	116	47	53	116	48	13
	S1												

a. Data pengamatan jarak tahun 2013 (diukur menggunakan Nikon DTM-352 dengan ketelitian jarak alat 3 mm)

Titik Berdiri Alat	Target	Ukuran I	Ukuran II	Ukuran III	Ukuran IV	Ukuran V	Ukuran VI	Ukuran VII	Ukuran VIII
S1	S2	23,485	23,486	23,485	23,486	23,483	23,483	23,483	23,483
S2	S3	22,638	22,638	22,637	22,637	22,640	22,640	22,640	22,640
S3	S4	23,851	23,851	23,851	23,851	23,852	23,852	23,852	23,852
S4	S5	21,841	21,841	21,842	21,842	21,840	21,839	21,840	21,840
S5	S6	22,907	22,907	22,906	22,906	22,908	22,908	22,907	22,907
S6	S7	20,839	20,840	20,840	20,840	20,840	20,840	20,840	20,839
S7	S8	22,194	22,194	22,194	22,194	22,195	22,193	22,193	22,195
S8	S1	23,956	23,957	23,957	23,956	23,958	23,958	23,957	23,957

LAMPIRAN E

DATA PENGAMATAN TAHUN 2015_1

b. Data pengamatan sudut tahun 2015 (diukur menggunakan Nikon DTM-352 dengan ketelitian alat 5")

Titik Berdiri Alat	Target	Ukuran Sudut I			Ukuran Sudut II			Ukuran Sudut III			Ukuran Sudut IV		
		Derajat	Menit	Sekon	Derajat	Menit	Sekon	Derajat	Menit	Sekon	Derajat	Menit	Sekon
S1	S2	137	57	24	137	57	22	137	57	26	137	57	25
	S8												
S2	S1	116	0	59	116	1	0	116	0	59	116	1	0
	S3												
S3	S2	166	30	39	166	30	40	166	30	39	166	30	39
	S4												
S4	S3	112	53	39	112	53	38	112	53	37	112	53	38
	S5												
S5	S4	143	23	04	143	23	1	143	23	0	143	23	1
	S6												
S6	S5	119	26	10	119	26	13	119	26	10	119	26	13
	S7												
S7	S6	166	58	58	166	59	1	166	59	1	166	58	59
	S8												
S8	S7	116	47	56	116	47	56	116	47	56	116	47	57
	S1												

b. Data pengamatan jarak tahun 2015 (diukur menggunakan Nikon DTM-352 dengan ketelitian jarak alat 3 mm)

Titik Berdiri Alat	Target	Ukuran I	Ukuran II	Ukuran III	Ukuran IV	Ukuran V	Ukuran VI	Ukuran VII	Ukuran VIII
S1	S2	23,487	23,486	23,486	23,487	23,487	23,487	23,487	23,487
S2	S3	22,641	22,641	22,640	22,641	22,640	22,640	22,640	22,641
S3	S4	23,852	23,852	23,852	23,852	23,852	23,852	23,852	23,852
S4	S5	21,841	21,841	21,841	21,841	21,840	21,840	21,841	21,840
S5	S6	22,910	22,910	22,910	22,910	22,909	22,909	22,909	22,911
S6	S7	20,838	20,837	20,838	20,838	20,837	20,838	20,838	20,837
S7	S8	22,194	22,195	22,195	22,195	22,193	22,193	22,193	22,193
S8	S1	23,958	23,958	23,958	23,958	23,957	23,957	23,957	23,957

LAMPIRAN F

DATA PENGAMATAN TAHUN 2015_2

a. Data pengamatan sudut tahun 2015_2 (diukur menggunakan Nikon DTM-352 dengan ketelitian alat 5")

Titik Berdiri Alat	Target	Ukuran Sudut I			Ukuran Sudut II			Ukuran Sudut III			Ukuran Sudut IV		
		Derajat	Menit	Sekon	Derajat	Menit	Sekon	Derajat	Menit	Sekon	Derajat	Menit	Sekon
S1	S2	137	57	37	137	57	35	137	57	40	137	57	39
	S8												
S2	S1	116	1	9	116	1	10	116	1	12	116	1	7
	S3												
S3	S2	166	31	9	166	31	1	166	31	8	166	30	59
	S4												
S4	S3	112	53	33	112	53	33	112	53	34	112	53	36
	S5												
S5	S4	143	22	54	143	22	51	143	22	52	143	22	53
	S6												
S6	S5	119	26	6	119	26	3	119	26	8	119	26	7
	S7												
S7	S6	166	59	24	166	59	24	166	59	26	166	48	21
	S8												
S8	S7	116	48	20	116	48	19	116	48	20	116	48	21
	S1												

c. Data pengamatan jarak tahun 2015 (diukur menggunakan Nikon DTM-352 dengan ketelitian jarak alat 3 mm)

Titik Berdiri Alat	**Target**	**Ukuran I**	**Ukuran II**	**Ukuran III**	**Ukuran IV**	**Ukuran V**	**Ukuran VI**	**Ukuran VII**	**Ukuran VIII**
S1	S2	23,487	23,482	23,482	23,482	23,483	23,485	23,486	23,485
S2	S3	22,641	22,637	22,637	22,637	22,637	22,641	22,641	22,641
S3	S4	23,852	23,849	23,849	23,849	23,849	23,849	23,849	23,85
S4	S5	21,841	21,839	21,838	21,839	21,838	21,838	21,839	21,839
S5	S6	22,910	22,908	22,908	22,908	22,908	22,907	22,908	22,908
S6	S7	20,838	20,835	20,835	20,835	20,835	20,834	20,834	20,835
S7	S8	22,194	22,193	22,193	22,193	22,193	22,192	22,192	22,193
S8	S1	23,958	23,956	23,956	23,956	23,956	23,958	23,958	23,958

LAMPIRAN G

HASIL UJI PERGESERAN TITIK *EPOCH* 1999

Epoch	**Titik**	**W_d (Nilai Uji 2,0096)**	**Hasil Uji**
1999	X_{S1}	$0{,}0116768 \times 10^{14}$	Ditolak
	Y_{S1}	$0{,}0096828 \times 10^{14}$	Ditolak
	X_{S2}	$0{,}0116330 \times 10^{14}$	Ditolak
	Y_{S2}	$0{,}0096824 \times 10^{14}$	Ditolak
	X_{S3}	$0{,}0116755 \times 10^{14}$	Ditolak
	Y_{S3}	$0{,}0096829 \times 10^{14}$	Ditolak
	X_{S4}	$0{,}0116745 \times 10^{14}$	Ditolak
	Y_{S4}	$0{,}0096827 \times 10^{14}$	Ditolak
	X_{S5}	$0{,}0116740 \times 10^{14}$	Ditolak
	Y_{S5}	$0{,}0096827 \times 10^{14}$	Ditolak
	X_{S6}	$0{,}0116745 \times 10^{14}$	Ditolak
	Y_{S6}	$0{,}0096828 \times 10^{14}$	Ditolak
	X_{S7}	$0{,}0116755 \times 10^{14}$	Ditolak
	Y_{S7}	$0{,}0096828 \times 10^{14}$	Ditolak
	X_{S8}	$0{,}0116767 \times 10^{14}$	Ditolak
	Y_{S8}	$0{,}00968282 \times 10^{14}$	Ditolak
	X_{S1}	$0{,}0244396 \times 10^{14}$	Ditolak
	Y_{S1}	$6{,}076352 \times 10^{14}$	Ditolak
	X_{S2}	$0{,}136903 \times 10^{14}$	Ditolak
	Y_{S2}	$6{,}076511 \times 10^{14}$	Ditolak
	X_{S3}	$0{,}024481 \times 10^{14}$	Ditolak
	Y_{S3}	$6{,}07628 \times 10^{14}$	Ditolak
	X_{S4}	$0{,}024463 \times 10^{14}$	Ditolak
	Y_{S4}	$6{,}076445 \times 10^{14}$	Ditolak
	X_{S5}	$0{,}02445 \times 10^{14}$	Ditolak
	Y_{S5}	$6{,}076487 \times 10^{14}$	Ditolak
	X_{S6}	$0{,}02446 \times 10^{14}$	Ditolak
	Y_{S6}	$6{,}07650 \times 10^{14}$	Ditolak
	X_{S7}	$0{,}02449 \times 10^{14}$	Ditolak

Lanjutan Tabel Uji Pergeseran Titik *epoch* 1999

	Y_{S7}	$6{,}07648 \times 10^{14}$	Ditolak
	X_{S8}	$0{,}024523 \times 10^{14}$	Ditolak
	Y_{S8}	$6{,}07644 \times 10^{14}$	Ditolak

LAMPIRAN H

HASIL UJI PERGESERAN TITIK *EPOCH* 2001

Epoch	**Titik**	**W_d (Nilai Uji 2,0096)**	**Hasil Uji**
2001	X_{S1}	$2{,}8075 \times 10^{15}$	Ditolak
	Y_{S1}	$0{,}16256 \times 10^{15}$	Ditolak
	X_{S2}	$2{,}89170 \times 10^{15}$	Ditolak
	Y_{S2}	$0{,}162565 \times 10^{15}$	Ditolak
	X_{S3}	$2{,}807168 \times 10^{15}$	Ditolak
	Y_{S3}	$0{,}162559 \times 10^{15}$	Ditolak
	X_{S4}	$2{,}806869 \times 10^{15}$	Ditolak
	Y_{S4}	$0{,}162559 \times 10^{15}$	Ditolak
	X_{S5}	$2{,}806793 \times 10^{15}$	Ditolak
	Y_{S5}	$0{,}1625635 \times 10^{15}$	Ditolak
	X_{S6}	$2{,}806895 \times 10^{15}$	Ditolak
	Y_{S6}	$0{,}16256 \times 10^{15}$	Ditolak
	X_{S7}	$2{,}80715 \times 10^{15}$	Ditolak
	Y_{S7}	$0{,}1625635 \times 10^{15}$	Ditolak
	X_{S8}	$2{,}8074351 \times 10^{15}$	Ditolak
	Y_{S8}	$0{,}1625630 \times 10^{15}$	Ditolak
	X_{S1}	$0{,}98950 \times 10^{15}$	Ditolak
	Y_{S1}	$0{,}0683286 \times 10^{15}$	Ditolak
	X_{S2}	$0{,}9549456 \times 10^{15}$	Ditolak
	Y_{S2}	$0{,}0683260 \times 10^{15}$	Ditolak
	X_{S3}	$0{,}989400 \times 10^{15}$	Ditolak
	Y_{S3}	$0{,}0683295 \times 10^{15}$	Ditolak
	X_{S4}	$0{,}989312 \times 10^{15}$	Ditolak
	Y_{S4}	$0{,}068326 \times 10^{15}$	Ditolak
	X_{S5}	$0{,}9892745 \times 10^{15}$	Ditolak
	Y_{S5}	$0{,}068328 \times 10^{15}$	Ditolak
	X_{S6}	$0{,}98931 \times 10^{15}$	Ditolak
	Y_{S6}	$0{,}068328 \times 10^{15}$	Ditolak
	X_{S7}	$0{,}989403 \times 10^{15}$	Ditolak

Lanjutan Tabel Uji Pergeseran Titik *epoch* 2001

	Y_{S7}	$0{,}068328 \times 10^{15}$	Ditolak
	X_{S8}	$0{,}9895017 \times 10^{15}$	Ditolak
	Y_{S8}	$0{,}068328 \times 10^{15}$	Ditolak

LAMPIRAN I

HASIL UJI PERGESERAN TITIK *EPOCH* 2011

Epoch	Titik	W_d (Nilai Uji 2,0096)	Hasil Uji
2011	X_{S1}	$5{,}26462 \times 10^{13}$	Ditolak
	Y_{S1}	$3{,}5944766 \times 10^{13}$	Ditolak
	X_{S2}	$5{,}03811 \times 10^{13}$	Ditolak
	Y_{S2}	$3{,}5944358 \times 10^{13}$	Ditolak
	X_{S3}	$5{,}26475 \times 10^{13}$	Ditolak
	Y_{S3}	$3{,}5944168 \times 10^{13}$	Ditolak
	X_{S4}	$5{,}26479 \times 10^{13}$	Ditolak
	Y_{S4}	$3{,}5944158 \times 10^{13}$	Ditolak
	X_{S5}	$5{,}264832 \times 10^{13}$	Ditolak
	Y_{S5}	$3{,}5944135 \times 10^{13}$	Ditolak
	X_{S6}	$5{,}2648488 \times 10^{13}$	Ditolak
	Y_{S6}	$3{,}5944549 \times 10^{13}$	Ditolak
	X_{S7}	$5{,}264824 \times 10^{13}$	Ditolak
	Y_{S7}	$3{,}59448 \times 10^{13}$	Ditolak
	X_{S8}	$5{,}264787 \times 10^{13}$	Ditolak
	Y_{S8}	$3{,}59448 \times 10^{13}$	Ditolak
	X_{S1}	$2{,}0045696 \times 10^{13}$	Ditolak
	Y_{S1}	$0{,}693789 \times 10^{13}$	Ditolak
	X_{S2}	$1{,}9839511 \times 10^{13}$	Ditolak
	Y_{S2}	$0{,}6937604 \times 10^{13}$	Ditolak
	X_{S3}	$2{,}0043398 \times 10^{13}$	Ditolak
	Y_{S3}	$0{,}693793 \times 10^{13}$	Ditolak
	X_{S4}	$2{,}0041285 \times 10^{13}$	Ditolak
	Y_{S4}	$0{,}693780 \times 10^{13}$	Ditolak
	X_{S5}	$2{,}0040749 \times 10^{13}$	Ditolak
	Y_{S5}	$0{,}6937811 \times 10^{13}$	Ditolak
	X_{S6}	$2{,}0041489 \times 10^{13}$	Ditolak
	Y_{S6}	$0{,}693788 \times 10^{13}$	Ditolak
	X_{S7}	$2{,}004335 \times 10^{13}$	Ditolak

Lanjutan Tabel Uji Pergeseran Titik *epoch* 2011

	Y_{S7}	$0{,}69379089 \times 10^{13}$	Ditolak
	X_{S8}	$2{,}0045338 \times 10^{13}$	Ditolak
	Y_{S8}	$0{,}693786899 \times 10^{13}$	Ditolak

LAMPIRAN J

HASIL UJI SIGNIFIKANSI PARAMETER *EPOCH* 1999 S.D. 2001

Epoch	**Titik**	**J (Nilai Uji 2,13185)**	**Hasil Uji**
1999 s.d. 2001	X_{S1}	2,35435	Bergeser signifikan
	Y_{S1}	0,19228	Tidak bergeser signifikan
	X_{S2}	315,659	Bergeser signifikan
	Y_{S2}	1,466	Tidak bergeser signifikan
	X_{S3}	3,431	Bergeser signifikan
	Y_{S3}	2,344	Bergeser signifikan
	X_{S4}	7,612	Bergeser signifikan
	Y_{S4}	0,201	Tidak bergeser signifikan
	X_{S5}	5,097	Bergeser signifikan
	Y_{S5}	2,340	Bergeser signifikan
	X_{S6}	6,408	Bergeser signifikan
	Y_{S6}	3,803	Bergeser signifikan
	X_{S7}	4,465	Bergeser signifikan
	Y_{S7}	1,049	Tidak bergeser signifikan
	X_{S8}	2,129	Tidak bergeser signifikan
	Y_{S8}	1,419	Tidak bergeser signifikan

LAMPIRAN K

HASIL UJI SIGNIFIKANSI PARAMETER *EPOCH* 2001 S.D. 2011

Epoch	**Titik**	**J (Nilai Uji 2,13185)**	**Hasil Uji**
2001 s.d. 2011	X_{S1}	1,785	Tidak bergeser signifikan
	Y_{S1}	2,863	Bergeser signifikan
	X_{S2}	535,959	Bergeser signifikan
	Y_{S2}	2,922	Bergeser signifikan
	X_{S3}	73,148	Bergeser signifikan
	Y_{S3}	181.017	Bergeser signifikan
	X_{S4}	1108,070	Bergeser signifikan
	Y_{S4}	397,024	Bergeser signifikan
	X_{S5}	1,957	Tidak bergeser signifikan
	Y_{S5}	7,641	Bergeser signifikan
	X_{S6}	9,768	Bergeser signifikan
	Y_{S6}	7,095	Bergeser signifikan
	X_{S7}	9,523	Bergeser signifikan
	Y_{S7}	2,477	Bergeser signifikan
	X_{S8}	5,826	Bergeser signifikan
	Y_{S8}	2,054	Tidak bergeser signifikan

LAMPIRAN L

HASIL UJI SIGNIFIKANSI PARAMETER *EPOCH* 2011 S.D. 2013

Epoch	**Titik**	**J (Nilai Uji 2,13185)**	**Hasil Uji**
2011 s.d. 2013	X_{S1}	0,342	Tidak bergeser signifikan
	Y_{S1}	0,454	Tidak bergeser signifikan
	X_{S2}	157,251	Bergeser signifikan
	Y_{S2}	4,457	Bergeser signifikan
	X_{S3}	3,550	Bergeser signifikan
	Y_{S3}	1,449	Tidak bergeser signifikan
	X_{S4}	4,072	Bergeser signifikan
	Y_{S4}	1,993	Tidak bergeser signifikan
	X_{S5}	4,794	Bergeser signifikan
	Y_{S5}	1,200	Tidak bergeser signifikan
	X_{S6}	6,865	Bergeser signifikan
	Y_{S6}	0,207	Tidak bergeser signifikan
	X_{S7}	6,645	Bergeser signifikan
	Y_{S7}	0,810	Tidak bergeser signifikan
	X_{S8}	3,769	Bergeser signifikan
	Y_{S8}	0,991	Tidak bergeser signifikan

LAMPIRAN M

SCRIPT HITUNG PERATAAN KUADRAT TERKECIL METODE *INNER CONSTRAINT* *EPOCH* 1999 S.D. 2001

```
% Perataan Inner Constraint untuk Monitoring Deformasi Candi Siwa
% Dibuat Oleh : Adib Muhammad Shodiq (11/319033/TK/38170)
% Jurusan Teknik Geodesi UGM

% Perataan Epoch Pertama (1999)
clc;
format long

n = 16;
u = 16;
d = 4; %rank defect

% Jarak ukuran
ju1 = 23.489;
ju2 = 22.8;
ju3 = 21.58;
ju4 = 23.365;
ju5 = 22.908;
ju6 = 20.84;
ju7 = 22.195;
ju8 = 23.954;

ro = 1/sin((1/3600)/180*pi);
% Sudut Ukuran
su1 = 137.9516667;
su2 = 116.9161111;
su3 = 166.3355556;
su4 = 116.5411111;
su5 = 139.0213889;
su6 = 119.4286111;
su7 = 166.9919444;
su8 = 116.8036111;

% Azimuth 1-2
az1 = 199.3683333;

% Koordinat titik 1
x1 = 443924;
y1 = 9143085;
% Koordinat Pendekatan
x2 = 443916.2101;
y2 = 9143062.84;
x3 = 443893.6077;
y3 = 9143059.845;
x4 = 443872.1506;
y4 = 9143062.144;
x5 = 443863.9969;
y5 = 9143084.04;
x6 = 443872.0397;
y6 = 9143105.489;
x7 = 443892.6303;
y7 = 9143108.704;
x8 = 443914.7676;
y8 = 9143107.104;

% Matriks Bobot
```

```
P1=1^2+(2^2*(ju1/1000)*(ju1/1000))/1000000;
P2=1^2+(2^2*(ju2/1000)*(ju2/1000))/1000000;
P3=1^2+(2^2*(ju3/1000)*(ju3/1000))/1000000;
P4=1^2+(2^2*(ju4/1000)*(ju4/1000))/1000000;
P5=1^2+(2^2*(ju5/1000)*(ju5/1000))/1000000;
P6=1^2+(2^2*(ju6/1000)*(ju6/1000))/1000000;
P7=1^2+(2^2*(ju7/1000)*(ju7/1000))/1000000;
P8=1^2+(2^2*(ju8/1000)*(ju8/1000))/1000000;
P9=(((0.5^2/ju1^2)+(0.5^2/ju8^2)+(0.5^2/(ju1^2*ju8^2)))*(ju1^2+ju8^2
-
(2*ju1*ju8*cos(su1*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju1^2+ju8^2)/(ju1^2*ju8^2))*0.5^2*ro^2);
P10=(((0.5^2/ju2^2)+(0.5^2/ju1^2)+(0.5^2/(ju2^2*ju1^2)))*(ju2^2+ju1^
2-
(2*ju2*ju1*cos(su2*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju2^2+ju1^2)/(ju2^2*ju1^2))*0.5^2*ro^2);
P11=(((0.5^2/ju3^2)+(0.5^2/ju2^2)+(0.5^2/(ju3^2*ju2^2)))*(ju3^2+ju2^
2-
(2*ju3*ju2*cos(su3*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju3^2+ju2^2)/(ju3^2*ju2^2))*0.5^2*ro^2);
P12=(((0.5^2/ju4^2)+(0.5^2/ju3^2)+(0.5^2/(ju4^2*ju3^2)))*(ju4^2+ju3^
2-
(2*ju4*ju3*cos(su4*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju4^2+ju3^2)/(ju4^2*ju3^2))*0.5^2*ro^2);
P13=(((0.5^2/ju5^2)+(0.5^2/ju4^2)+(0.5^2/(ju5^2*ju4^2)))*(ju5^2+ju4^
2-
(2*ju5*ju4*cos(su5*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju5^2+ju4^2)/(ju5^2*ju4^2))*0.5^2*ro^2);
P14=(((0.5^2/ju6^2)+(0.5^2/ju5^2)+(0.5^2/(ju6^2*ju5^2)))*(ju6^2+ju5^
2-
(2*ju6*ju5*cos(su6*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju6^2+ju5^2)/(ju6^2*ju5^2))*0.5^2*ro^2);
P15=(((0.5^2/ju7^2)+(0.5^2/ju6^2)+(0.5^2/(ju7^2*ju6^2)))*(ju7^2+ju6^
2-
(2*ju7*ju6*cos(su7*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju7^2+ju6^2)/(ju7^2*ju6^2))*0.5^2*ro^2);
P16=(((0.5^2/ju8^2)+(0.5^2/ju7^2)+(0.5^2/(ju8^2*ju7^2)))*(ju8^2+ju7^
2-
(2*ju8*ju7*cos(su8*pi/180))))*ro+(3^2/(2*4^2))*ro+(((60/30)^2)/4)*ro
+(((ju8^2+ju7^2)/(ju8^2*ju7^2))*0.5^2*ro^2);

P=zeros(n);
for i=1:n
    P(1,1)=1/P1;
    P(2,2)=1/P2;
    P(3,3)=1/P3;
    P(4,4)=1/P4;
    P(5,5)=1/P5;
    P(6,6)=1/P6;
    P(7,7)=1/P7;
    P(8,8)=1/P8;
    P(9,9)=1/P9;
    P(10,10)=1/P10;
    P(11,11)=1/P11;
    P(12,12)=1/P12;
    P(13,13)=1/P13;
    P(14,14)=1/P14;
```

```
    P(15,15)=1/P15;
    P(16,16)=1/P16;
end

disp ('P = ');
disp (P);
disp ('-------------------------------------------------------------');

iterasi=3;
for i=1:iterasi;
% Persamaan Pengamatan Jarak
jh1=sqrt((x2-x1)^2+(y2-y1)^2);
jh2=sqrt((x3-x2)^2+(y3-y2)^2);
jh3=sqrt((x4-x3)^2+(y4-y3)^2);
jh4=sqrt((x5-x4)^2+(y5-y4)^2);
jh5=sqrt((x6-x5)^2+(y6-y5)^2);
jh6=sqrt((x7-x6)^2+(y7-y6)^2);
jh7=sqrt((x8-x7)^2+(y8-y7)^2);
jh8=sqrt((x1-x8)^2+(y1-y8)^2);

% Persamaan Pengamatan Sudut
sh1=(atand((x8-x1)/(y8-y1))-atand((x2-x1)/(y2-y1)))+180;
sh2=(atand((x1-x2)/(y1-y2))-atand((x3-x2)/(y3-y2)))+180;
sh3=(atand((x2-x3)/(y2-y3))-atand((x4-x3)/(y4-y3)));
sh4=(atand((x3-x4)/(y3-y4))-atand((x5-x4)/(y5-y4)))+180;
sh5=(atand((x4-x5)/(y4-y5))-atand((x6-x5)/(y6-y5)))+180;
sh6=(atand((x5-x6)/(y5-y6))-atand((x7-x6)/(y7-y6)))+180;
sh7=(atand((x6-x7)/(y6-y7))-atand((x8-x7)/(y8-y7)));
sh8=(atand((x7-x8)/(y7-y8))-atand((x1-x8)/(y1-y8)))+180;

% Turunan Persamaan Normal terhadap Parameter
a1_1=-(x2-x1)/jh1;  %x1
a1_2=-(y2-y1)/jh1;  %y1
a1_3=(x2-x1)/jh1;   %x2
a1_4=(y2-y1)/jh1;   %y2
a2_3=-(x3-x2)/jh2;  %x2
a2_4=-(y3-y2)/jh2;  %y2
a2_5=(x3-x2)/jh2;   %x3
a2_6=(y3-y2)/jh2;   %y3
a3_5=-(x4-x3)/jh3;  %x3
a3_6=-(y4-y3)/jh3;  %y3
a3_7=(x4-x3)/jh3;   %x4
a3_8=(y4-y3)/jh3;   %y4
a4_7=-(x5-x4)/jh4;  %x4
a4_8=-(y5-y4)/jh4;  %y4
a4_9=(x5-x4)/jh4;   %x5
a4_10=(y5-y4)/jh4;  %y5
a5_9=-(x6-x5)/jh5;  %x5
a5_10=-(y6-y5)/jh5; %y5
a5_11=(x6-x5)/jh5;  %x6
a5_12=(y6-y5)/jh5;  %y6
a6_11=-(x7-x6)/jh6; %x6
a6_12=-(y7-y6)/jh6; %y6
a6_13=(x7-x6)/jh6;  %x7
a6_14=(y7-y6)/jh6;  %y7
a7_13=-(x8-x7)/jh7; %x7
a7_14=-(y8-y7)/jh7; %y7
```

```
a7_15=(x8-x7)/jh7;  %x8
a7_16=(y8-y7)/jh7;  %y8
a8_1=(x1-x8)/jh8;   %x1
a8_2=(y1-y8)/jh8;   %y1
a8_15=-(x1-x8)/jh8; %x8
a8_16=-(y1-y8)/jh8; %y8
a9_1=((-(y8-y1)/jh8^2))+((y2-y1)/jh1^2)*ro; %x1
a9_2=((-(x8-x1)/jh8^2))-((x2-x1)/jh1^2)*ro;     %y1
a9_3=(-(y2-y1)/jh1^2)*ro;   %x2
a9_4=((x2-x1)/jh1^2)*ro;    %y2
a9_15=((y8-y1)/jh8^2)*ro;   %x8
a9_16=(-(x8-x1)/jh8^2)*ro;  %y8
a10_1=((y1-y2)/jh1^2)*ro;   %x1
a10_2=(-(x1-x2)/jh1^2)*ro;  %y1
a10_3=(-(y1-y2/jh1^2))+((y3-y2)/jh2^2)*ro;  %x2
a10_4=(-(x1-x2)/jh1^2)-((x3-x2)/jh2^2)*ro;  %y2
a10_5=(-(y3-y2)/jh2^2)*ro;  %x3
a10_6=((x3-x2)/jh2^2)*ro;   %y3
a11_3=((y2-y3)/jh2^2)*ro;   %x2
a11_4=(-(x2-x3)/jh2^2)*ro;  %y2
a11_5=(((y2-y3)/jh2^2)+((y4-y3)/jh3^2))*ro;     %x3
a11_6=((-(x2-x3)/jh2^2)-((x4-x3)/jh3^2))*ro;    %y3
a11_7=(-(y4-y3)/jh3^2)*ro;  %x4
a11_8=((x4-x3)/jh3^2)*ro;   %y4
a12_5=((y3-y4)/jh3^2)*ro;   %x3
a12_6=(-(x3-x4)/jh3^2)*ro;  %y3
a12_7=((-(y3-y4)/jh3^2)+((y5-y4)/jh4^2))*ro;    %x4
a12_8=(((x3-x4)/jh3^2)-((x5-x4)/jh4^2))*ro;     %y4
a12_9=(-(y5-y4)/jh4^2)*ro;  %x5
a12_10=((x5-x4)/jh4^2)*ro;  %y5
a13_7=((y4-y5)/jh4^2)*ro;   %x4
a13_8=(-(x4-x5)/jh4^2)*ro;  %y4
a13_9=((-(y4-y5)/jh4^2)+((y6-y5)/jh5^2))*ro;    %x5
a13_10=(((x4-x5)/jh4^2)-((x6-x5)/jh5^2))*ro;        %y5
a13_11=(-(y6-y5)/jh5^2)*ro; %x6
a13_12=((x6-x5)/jh5^2)*ro;  %y6
a14_9=((y5-y6)/jh5^2)*ro;   %x5
a14_10=(-(x5-x6)/jh5^2)*ro; %y5
a14_11=((-(y5-y6)/jh5^2)+((y7-y6)/jh6^2))*ro;   %x6
a14_12=(((x5-x6)/jh5^2)-((x7-x6)/jh6^2))*ro;    %y6
a14_13=(-(y7-y6)/jh6^2)*ro; %x7
a14_14=((x7-x6)/jh6^2)*ro;  %y7
a15_11=((y6-y7)/jh6^2)*ro;  %x6
a15_12=(-(x6-x7)/jh6^2)*ro; %y6
a15_13=((-(y6-y7)/jh6^2)+((y8-y7)/jh7^2))*ro;   %x7
a15_14=(((x6-x7)/jh6^2)-((x8-x7)/jh7^2))*ro;    %y7
a15_15=(-(y8-y7)/jh7^2)*ro; %x8
a15_16=((x8-x7)/jh7^2)*ro;  %y8
a16_1=(-(y1-y8)/jh8^2)*ro;  %x1
a16_2=((x1-x8)/jh8^2)*ro;   %y1
a16_13=((y7-y8)/jh7^2)*ro;  %x7
a16_14=(-(x7-x8)/jh7^2)*ro; %y7
a16_15=((-(y7-y8)/jh7^2)+((y1-y8)/jh8^2))*ro;       %x8
a16_16=(((x7-x8)/jh7^2)-((x1-x8)/jh8^2))*ro;        %y8

% Matriks A
A=zeros(n);
```

```
for i=1:n
    A(1,1)=a1_1;
    A(1,2)=a1_2;
    A(1,3)=a1_3;
    A(1,4)=a1_4;
    A(2,3)=a2_3;
    A(2,4)=a2_4;
    A(2,5)=a2_5;
    A(2,6)=a2_6;
    A(3,5)=a3_5;
    A(3,6)=a3_6;
    A(3,7)=a3_7;
    A(3,8)=a3_8;
    A(4,7)=a4_7;
    A(4,8)=a4_8;
    A(4,9)=a4_9;
    A(4,10)=a4_10;
    A(5,9)=a5_9;
    A(5,10)=a5_10;
    A(5,11)=a5_11;
    A(5,12)=a5_12;
    A(6,11)=a6_11;
    A(6,12)=a6_12;
    A(6,13)=a6_13;
    A(6,14)=a6_14;
    A(7,13)=a7_13;
    A(7,14)=a7_14;
    A(7,15)=a7_15;
    A(7,16)=a7_16;
    A(8,1)=a8_1;
    A(8,2)=a8_2;
    A(8,15)=a8_15;
    A(8,16)=a8_16;
    A(9,1)=a9_1;
    A(9,2)=a9_2;
    A(9,3)=a9_3;
    A(9,4)=a9_4;
    A(9,15)=a9_15;
    A(9,16)=a9_16;
    A(10,1)=a10_1;
    A(10,2)=a10_2;
    A(10,3)=a10_3;
    A(10,4)=a10_4;
    A(10,5)=a10_5;
    A(10,6)=a10_6;
    A(11,3)=a11_3;
    A(11,4)=a11_4;
    A(11,5)=a11_5;
    A(11,6)=a11_6;
    A(11,7)=a11_7;
    A(11,8)=a11_8;
    A(12,5)=a12_5;
    A(12,6)=a12_6;
    A(12,7)=a12_7;
    A(12,8)=a12_8;
    A(12,9)=a12_9;
    A(12,10)=a12_10;
    A(13,7)=a13_7;
```

```
    A(13,8)=a13_8;
    A(13,9)=a13_9;
    A(13,10)=a13_10;
    A(13,11)=a13_11;
    A(13,12)=a13_12;
    A(14,9)=a14_9;
    A(14,10)=a14_10;
    A(14,11)=a14_11;
    A(14,12)=a14_12;
    A(14,13)=a14_13;
    A(14,14)=a14_14;
    A(15,11)=a15_11;
    A(15,12)=a15_12;
    A(15,13)=a15_13;
    A(15,14)=a15_14;
    A(15,15)=a15_15;
    A(15,16)=a15_16;
    A(16,1)=a16_1;
    A(16,2)=a16_2;
    A(16,13)=a16_13;
    A(16,14)=a16_14;
    A(16,15)=a16_15;
    A(16,16)=a16_16;
end
disp ('A = ');
disp (A);
disp ('-----------------------------------------------');

% Matriks F
F=[jh1-ju1;
    jh2-ju2;
    jh3-ju3;
    jh4-ju4;
    jh5-ju5;
    jh6-ju6;
    jh7-ju7;
    jh8-ju8;
    (sh1-su1);
    (sh2-su2);
    (sh3-su3);
    (sh4-su4);
    (sh5-su5);
    (sh6-su6);
    (sh7-su7);
    (sh8-su8)];
disp ('F = ');
disp (F);
disp ('-----------------------------------------------');

%Matriks E
E=zeros((d),(n));
    E(1,1)=1;
    E(2,2)=1;
    E(3,1)=y1;
    E(3,2)=-x1;
    E(4,1)=x1;
    E(4,2)=y1;
```

```
    E(1,3)=1;
    E(2,4)=1;
    E(3,3)=y2;
    E(3,4)=-x2;
    E(4,3)=x2;
    E(4,4)=y2;
    E(1,5)=1;
    E(2,6)=1;
    E(3,5)=y3;
    E(3,6)=-x3;
    E(4,5)=x3;
    E(4,6)=y3;
    E(1,7)=1;
    E(2,8)=1;
    E(3,7)=y4;
    E(3,8)=-x4;
    E(4,7)=x4;
    E(4,8)=y4;
    E(1,9)=1;
    E(2,10)=1;
    E(3,9)=y5;
    E(3,10)=-x5;
    E(4,9)=x5;
    E(4,10)=y5;
    E(1,11)=1;
    E(2,12)=1;
    E(3,11)=y6;
    E(3,12)=-x6;
    E(4,11)=x6;
    E(4,12)=y6;
    E(1,13)=1;
    E(2,14)=1;
    E(3,13)=y7;
    E(3,14)=-x7;
    E(4,13)=x7;
    E(4,14)=y7;
    E(1,15)=1;
    E(2,16)=1;
    E(3,15)=y8;
    E(3,16)=-x8;
    E(4,15)=x8;
    E(4,16)=y8;
disp ('E = ');
disp (E);
disp ('-----------------------------------------------');
N = A'*P*A;
disp ('N = ');
disp (N);
disp ('-----------------------------------------------');
nn = inv(N+(E'*E));
G = A'*P*F;
disp ('G = ');
disp (G);
disp ('-----------------------------------------------');
X = nn * G
V = (A*X)-F
```

```
%matriks pendekatan
X0=[x1;y1;x2;y2;x3;y3;x4;y4;x5;y5;x6;y6;x7;y7;x8;y8];

Xa=X+X0;
%pendefinisian matriks Xa
x1=Xa(1,1);
y1=Xa(2,1);
x2=Xa(3,1);
y2=Xa(4,1);
x3=Xa(5,1);
y3=Xa(6,1);
x4=Xa(7,1);
y4=Xa(8,1);
x5=Xa(9,1);
y5=Xa(10,1);
x6=Xa(11,1);
y6=Xa(12,1);
x7=Xa(13,1);
y7=Xa(14,1);
x8=Xa(15,1);
y8=Xa(16,1);
end

disp('--------------------------------');
dlmwrite('matriks_x1999.csv',X,'precision','%.8f','newline','pc')
type matriks_x1999.csv

disp('--------------------------------');
dlmwrite('koordinat_titik_pantau1999.csv',Xa,'precision','%.8f','new
line','pc')
type koordinat_titik_pantau1999.csv

disp('--------------------------------');
V=(A*X)-F;
disp('Matriks Residu (V)');
disp(V);

disp('--------------------------------');
aposteriori=(V'*P*V)/((n-u)+d)
dlmwrite('aposteriori_1999.csv',aposteriori,'precision','%.40f','new
line','pc')
type aposteriori_1999.csv

disp('--------------------------------');
sigmaxx=aposteriori*nn
dlmwrite('sigmaxx1999.csv',sigmaxx,'precision','%.30f','newline','pc
')
type sigmaxx1999.csv

disp('--------------------------------');
dlmwrite('inv_apa1999.csv',nn,'precision','%.8f','newline','pc')
type inv_apa1999.csv

disp('--------------------------------');
sigmavv=aposteriori*(inv(P)-(A*nn*A'));
sdV=diag(sigmavv).^(1/2)
```

```
disp('-------------------------------');
sdX=diag(sigmaxx).^(1/2);
dlmwrite('sdX1999.csv',sdX,'precision','%.30f','newline','pc')
type sdX1999.csv

 %proses uji global
   disp('uji global')
   varapri=1;
   postvarian=(aposteriori/varapri)
   if postvarian > 5.6281
   disp ('uji global Ho ditolak')
    elseif postvarian <= 5.6281
   disp ('uji global Ho diterima')
    end

   %proses uji snooping
  for i=1:n
    W(i)=V(i)/sdV(i);
  end


  disp('uji snooping')
  for i=1:n
uji_snooping = abs(W(i));
if uji_snooping <= 15.94723801
   disp ('uji snooping Ho diterima')
elseif uji_snooping > 15.94723801
   disp ('uji snooping Ho ditolak')
end
end
```

LAMPIRAN N

SCRIPT HITUNG PERATAAN KUADRAT TERKECIL METODE *INNER CONSTRAINT EPOCH* 2013 S.D. 2015_2

```
% Perataan Inner Constraint untuk Monitoring Deformasi Candi Siwa
% Dibuat Oleh : Adib Muhammad Shodiq (11/319033/TK/38170)
% Jurusan Teknik Geodesi UGM

% Perataan Epoch Keempat (2013)
clc;
format long

n = 32;
u = 16;
d = 4; %rank defect

% Jarak ukuran
ju1 = 23.486;
ju2 = 23.486;

ju3 = 22.64;
ju4 = 22.64;

ju5 = 23.852;
ju6 = 23.851;

ju7 = 21.839;
ju8 = 21.839;

ju9 = 22.907;
ju10 = 22.906;

ju11 = 20.839;
ju12 = 20.839;

ju13 = 22.194;
ju14 = 22.194;

ju15 = 23.956;
ju16 = 23.958;

ro = 1/sin((1/3600)/180*pi);
% Sudut Ukuran
su1 = 137.9616667;
su2 = 137.9551342;

su5 = 116.0355556;
su6 = 116.0354171;

su9 = 166.5;
su10 = 166.4979097;

su13 = 112.8983333;
su14 = 112.8981998;

su17 = 143.3861111;
```

```
su18 = 143.385971;

su22 = 119.4388889;
su23 = 119.4365392;

su26 = 166.9813889;
su27 = 166.9826421;

su31 = 116.7980556;
su32 = 116.8059646;

% Azimuth 1-2
az1 = 199.3683333;

% Koordinat titik 1
x1 = 443924;
y1 = 9143085;
% Koordinat Pendekatan
x2 = 443916.2116;
y2 = 9143062.842;
x3 = 443893.7251;
y3 = 9143060.213;
x4 = 443870.043;
y4 = 9143063.05;
x5 = 443863.9997;
y5 = 9143084.035;
x6 = 443872.0405;
y6 = 9143105.484;
x7 = 443892.6295;
y7 = 9143108.704;
x8 = 443914.7663;
y8 = 9143107.106;

% Matriks Bobot
P1=3^2+(3^2*(ju1/1000)*(ju1/1000))/1000000;
P2=3^2+(3^2*(ju2/1000)*(ju2/1000))/1000000;
P3=3^2+(3^2*(ju3/1000)*(ju3/1000))/1000000;
P4=3^2+(3^2*(ju4/1000)*(ju4/1000))/1000000;
P5=3^2+(3^2*(ju5/1000)*(ju5/1000))/1000000;
P6=3^2+(3^2*(ju6/1000)*(ju6/1000))/1000000;
P7=3^2+(3^2*(ju7/1000)*(ju7/1000))/1000000;
P8=3^2+(3^2*(ju8/1000)*(ju8/1000))/1000000;
P9=3^2+(3^2*(ju9/1000)*(ju9/1000))/1000000;
P10=3^2+(3^2*(ju10/1000)*(ju10/1000))/1000000;
P11=3^2+(3^2*(ju11/1000)*(ju11/1000))/1000000;
P12=3^2+(3^2*(ju12/1000)*(ju12/1000))/1000000;
P13=3^2+(3^2*(ju13/1000)*(ju13/1000))/1000000;
P14=3^2+(3^2*(ju14/1000)*(ju14/1000))/1000000;
P15=3^2+(3^2*(ju15/1000)*(ju15/1000))/1000000;
P16=3^2+(3^2*(ju16/1000)*(ju16/1000))/1000000;
P17=(((0.5^2/ju1^2)+(0.5^2/ju15^2)+(0.5^2/(ju1^2*ju15^2)))*(ju1^2+ju
15^2-
(2*ju1*ju15*cos(su1*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju1^2+ju15^2)/(ju1^2*ju15^2))*0.5^2*ro^2);
P18=(((0.5^2/ju2^2)+(0.5^2/ju16^2)+(0.5^2/(ju2^2*ju16^2)))*(ju2^2+ju
16^2-
```

```
(2*ju2*ju16*cos(su2*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju2^2+ju16^2)/(ju2^2*ju16^2))*0.5^2*ro^2);
P19=(((0.5^2/ju3^2)+(0.5^2/ju1^2)+(0.5^2/(ju3^2*ju1^2)))*(ju3^2+ju1^
2-
(2*ju3*ju1*cos(su5*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*r
o+(((ju3^2+ju1^2)/(ju3^2*ju1^2))*0.5^2*ro^2);
P20=(((0.5^2/ju4^2)+(0.5^2/ju2^2)+(0.5^2/(ju4^2*ju2^2)))*(ju4^2+ju2^
2-
(2*ju4*ju2*cos(su6*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*r
o+(((ju4^2+ju2^2)/(ju4^2*ju2^2))*0.5^2*ro^2);
P21=(((0.5^2/ju5^2)+(0.5^2/ju3^2)+(0.5^2/(ju5^2*ju3^2)))*(ju5^2+ju3^
2-
(2*ju5*ju3*cos(su9*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*r
o+(((ju5^2+ju3^2)/(ju5^2*ju3^2))*0.5^2*ro^2);
P22=(((0.5^2/ju6^2)+(0.5^2/ju4^2)+(0.5^2/(ju6^2*ju4^2)))*(ju6^2+ju4^
2-
(2*ju6*ju4*cos(su10*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju6^2+ju4^2)/(ju6^2*ju4^2))*0.5^2*ro^2);
P23=(((0.5^2/ju7^2)+(0.5^2/ju5^2)+(0.5^2/(ju7^2*ju5^2)))*(ju7^2+ju5^
2-
(2*ju7*ju5*cos(su13*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju7^2+ju5^2)/(ju7^2*ju5^2))*0.5^2*ro^2);
P24=(((0.5^2/ju8^2)+(0.5^2/ju6^2)+(0.5^2/(ju8^2*ju6^2)))*(ju8^2+ju6^
2-
(2*ju8*ju6*cos(su14*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju8^2+ju6^2)/(ju8^2*ju6^2))*0.5^2*ro^2);
P25=(((0.5^2/ju9^2)+(0.5^2/ju7^2)+(0.5^2/(ju9^2*ju7^2)))*(ju9^2+ju7^
2-
(2*ju9*ju7*cos(su17*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)*
ro+(((ju9^2+ju7^2)/(ju9^2*ju7^2))*0.5^2*ro^2);
P26=(((0.5^2/ju10^2)+(0.5^2/ju8^2)+(0.5^2/(ju10^2*ju8^2)))*(ju10^2+j
u8^2-
(2*ju10*ju8*cos(su18*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)
*ro+(((ju10^2+ju8^2)/(ju10^2*ju8^2))*0.5^2*ro^2);
P27=(((0.5^2/ju11^2)+(0.5^2/ju9^2)+(0.5^2/(ju11^2*ju9^2)))*(ju11^2+j
u9^2-
(2*ju11*ju9*cos(su22*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4)
*ro+(((ju11^2+ju9^2)/(ju11^2*ju9^2))*0.5^2*ro^2);
P28=(((0.5^2/ju12^2)+(0.5^2/ju10^2)+(0.5^2/(ju12^2*ju10^2)))*(ju12^2
+ju10^2-
(2*ju12*ju10*cos(su23*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4
)*ro+(((ju12^2+ju10^2)/(ju12^2*ju10^2))*0.5^2*ro^2);
P29=(((0.5^2/ju13^2)+(0.5^2/ju11^2)+(0.5^2/(ju13^2*ju11^2)))*(ju13^2
+ju11^2-
(2*ju13*ju11*cos(su26*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4
)*ro+(((ju13^2+ju11^2)/(ju13^2*ju11^2))*0.5^2*ro^2);
P30=(((0.5^2/ju14^2)+(0.5^2/ju12^2)+(0.5^2/(ju14^2*ju12^2)))*(ju14^2
+ju12^2-
(2*ju14*ju12*cos(su27*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4
)*ro+(((ju14^2+ju12^2)/(ju14^2*ju12^2))*0.5^2*ro^2);
P31=(((0.5^2/ju15^2)+(0.5^2/ju13^2)+(0.5^2/(ju15^2*ju13^2)))*(ju15^2
+ju13^2-
(2*ju15*ju13*cos(su31*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4
)*ro+(((ju15^2+ju13^2)/(ju15^2*ju13^2))*0.5^2*ro^2);
P32=(((0.5^2/ju16^2)+(0.5^2/ju14^2)+(0.5^2/(ju16^2*ju14^2)))*(ju16^2
+ju14^2-
(2*ju16*ju14*cos(su32*pi/180))))*ro+(60^2/(2*4^2))*ro+(((60/30)^2)/4
)*ro+(((ju16^2+ju14^2)/(ju16^2*ju14^2))*0.5^2*ro^2);
```

```
P=zeros(n);
for i=1:n
    P(1,1)=1/P1;
    P(2,2)=1/P2;
    P(3,3)=1/P3;
    P(4,4)=1/P4;
    P(5,5)=1/P5;
    P(6,6)=1/P6;
    P(7,7)=1/P7;
    P(8,8)=1/P8;
    P(9,9)=1/P9;
    P(10,10)=1/P10;
    P(11,11)=1/P11;
    P(12,12)=1/P12;
    P(13,13)=1/P13;
    P(14,14)=1/P14;
    P(15,15)=1/P15;
    P(16,16)=1/P16;
    P(17,17)=1/P17;
    P(18,18)=1/P18;
    P(19,19)=1/P19;
    P(20,20)=1/P20;
    P(21,21)=1/P21;
    P(22,22)=1/P22;
    P(23,23)=1/P23;
    P(24,24)=1/P24;
    P(25,25)=1/P25;
    P(26,26)=1/P26;
    P(27,27)=1/P27;
    P(28,28)=1/P28;
    P(29,29)=1/P29;
    P(30,30)=1/P30;
    P(31,31)=1/P31;
    P(32,32)=1/P32;

end
disp ('P = ');
disp (P);
disp ('-----------------------------------------------------');

iterasi=1;
for i=1:iterasi;
% Persamaan Pengamatan Jarak
jh1=sqrt((x2-x1)^2+(y2-y1)^2);
jh2=sqrt((x2-x1)^2+(y2-y1)^2);

jh3=sqrt((x3-x2)^2+(y3-y2)^2);
jh4=sqrt((x3-x2)^2+(y3-y2)^2);

jh5=sqrt((x4-x3)^2+(y4-y3)^2);
jh6=sqrt((x4-x3)^2+(y4-y3)^2);

jh7=sqrt((x5-x4)^2+(y5-y4)^2);
jh8=sqrt((x5-x4)^2+(y5-y4)^2);
```

```
jh9=sqrt((x6-x5)^2+(y6-y5)^2);
jh10=sqrt((x6-x5)^2+(y6-y5)^2);

jh11=sqrt((x7-x6)^2+(y7-y6)^2);
jh12=sqrt((x7-x6)^2+(y7-y6)^2);

jh13=sqrt((x8-x7)^2+(y8-y7)^2);
jh14=sqrt((x8-x7)^2+(y8-y7)^2);

jh15=sqrt((x1-x8)^2+(y1-y8)^2);
jh16=sqrt((x1-x8)^2+(y1-y8)^2);

% Persamaan Pengamatan Sudut
sh1=(atand((x8-x1)/(y8-y1))-atand((x2-x1)/(y2-y1)))+180;
sh2=(atand((x8-x1)/(y8-y1))-atand((x2-x1)/(y2-y1)))+180;

sh5=(atand((x1-x2)/(y1-y2))-atand((x3-x2)/(y3-y2)))+180;
sh6=(atand((x1-x2)/(y1-y2))-atand((x3-x2)/(y3-y2)))+180;

sh9=(atand((x2-x3)/(y2-y3))-atand((x4-x3)/(y4-y3)));
sh10=(atand((x2-x3)/(y2-y3))-atand((x4-x3)/(y4-y3)));

sh13=(atand((x3-x4)/(y3-y4))-atand((x5-x4)/(y5-y4)))+180;
sh14=(atand((x3-x4)/(y3-y4))-atand((x5-x4)/(y5-y4)))+180;

sh17=(atand((x4-x5)/(y4-y5))-atand((x6-x5)/(y6-y5)))+180;
sh18=(atand((x4-x5)/(y4-y5))-atand((x6-x5)/(y6-y5)))+180;

sh22=(atand((x5-x6)/(y5-y6))-atand((x7-x6)/(y7-y6)))+180;
sh23=(atand((x5-x6)/(y5-y6))-atand((x7-x6)/(y7-y6)))+180;

sh26=(atand((x6-x7)/(y6-y7))-atand((x8-x7)/(y8-y7)));
sh27=(atand((x6-x7)/(y6-y7))-atand((x8-x7)/(y8-y7)));

sh31=(atand((x7-x8)/(y7-y8))-atand((x1-x8)/(y1-y8)))+180;
sh32=(atand((x7-x8)/(y7-y8))-atand((x1-x8)/(y1-y8)))+180;

% Turunan Persamaan Normal terhadap Parameter

% Turunan Jarak
a1_1=-(x2-x1)/jh1;  %x1
a1_2=-(y2-y1)/jh1;  %y1
a1_3=(x2-x1)/jh1;   %x2
a1_4=(y2-y1)/jh1;   %y2
a2_1=-(x2-x1)/jh2;  %x1
a2_2=-(y2-y1)/jh2;  %y1
a2_3=(x2-x1)/jh2;   %x2
a2_4=(y2-y1)/jh2;   %y2

a5_3=-(x3-x2)/jh3;  %x2
a5_4=-(y3-y2)/jh3;  %y2
a5_5=(x3-x2)/jh3;   %x3
a5_6=(y3-y2)/jh3;   %y3
a6_3=-(x3-x2)/jh4;  %x2
a6_4=-(y3-y2)/jh4;  %y2
```

```
a6_5=(x3-x2)/jh4;    %x3
a6_6=(y3-y2)/jh4;    %y3

a9_5=-(x4-x3)/jh5;   %x3
a9_6=-(y4-y3)/jh5;   %y3
a9_7=(x4-x3)/jh5;    %x4
a9_8=(y4-y3)/jh5;    %y4
a10_5=-(x4-x3)/jh6;  %x3
a10_6=-(y4-y3)/jh6;  %y3
a10_7=(x4-x3)/jh6;   %x4
a10_8=(y4-y3)/jh6;   %y4

a13_7=-(x5-x4)/jh7;  %x4
a13_8=-(y5-y4)/jh7;  %y4
a13_9=(x5-x4)/jh7;   %x5
a13_10=(y5-y4)/jh7;  %y5
a14_7=-(x5-x4)/jh8;  %x4
a14_8=-(y5-y4)/jh8;  %y4
a14_9=(x5-x4)/jh8;   %x5
a14_10=(y5-y4)/jh8;  %y5

a17_9=-(x6-x5)/jh9;  %x5
a17_10=-(y6-y5)/jh9;     %y5
a17_11=(x6-x5)/jh9;  %x6
a17_12=(y6-y5)/jh9;  %y6
a18_9=-(x6-x5)/jh10;     %x5
a18_10=-(y6-y5)/jh10;    %y5
a18_11=(x6-x5)/jh10;     %x6
a18_12=(y6-y5)/jh10;     %y6

a21_11=-(x7-x6)/jh11;    %x6
a21_12=-(y7-y6)/jh11;    %y6
a21_13=(x7-x6)/jh11;     %x7
a21_14=(y7-y6)/jh11;     %y7
a22_11=-(x7-x6)/jh12;    %x6
a22_12=-(y7-y6)/jh12;    %y6
a22_13=(x7-x6)/jh12;     %x7
a22_14=(y7-y6)/jh12;     %y7

a25_13=-(x8-x7)/jh13;    %x7
a25_14=-(y8-y7)/jh13;    %y7
a25_15=(x8-x7)/jh13;     %x8
a25_16=(y8-y7)/jh13;     %y8
a26_13=-(x8-x7)/jh14;    %x7
a26_14=-(y8-y7)/jh14;    %y7
a26_15=(x8-x7)/jh14;     %x8
a26_16=(y8-y7)/jh14;     %y8

a29_1=(x1-x8)/jh15;  %x1
a29_2=(y1-y8)/jh15;  %y1
a29_15=-(x1-x8)/jh15;    %x8
a29_16=-(y1-y8)/jh15;    %y8
a30_1=(x1-x8)/jh16;  %x1
a30_2=(y1-y8)/jh16;  %y1
a30_15=-(x1-x8)/jh16;    %x8
a30_16=-(y1-y8)/jh16;    %y8
```

```
% Turunan Sudut
a33_1=((-(y8-y1)/jh15^2))+((y2-y1)/jh1^2)*ro;    %x1
a33_2=((-(x8-x1)/jh15^2))-((x2-x1)/jh1^2)*ro;        %y1
a33_3=(-(y2-y1)/jh1^2)*ro;  %x2
a33_4=((x2-x1)/jh1^2)*ro;   %y2
a33_15=((y8-y1)/jh15^2)*ro; %x8
a33_16=(-(x8-x1)/jh15^2)*ro;    %y8
a34_1=((-(y8-y1)/jh16^2))+((y2-y1)/jh2^2)*ro;    %x1
a34_2=((-(x8-x1)/jh16^2))-((x2-x1)/jh2^2)*ro;        %y1
a34_3=(-(y2-y1)/jh2^2)*ro;  %x2
a34_4=((x2-x1)/jh2^2)*ro;   %y2
a34_15=((y8-y1)/jh16^2)*ro; %x8
a34_16=(-(x8-x1)/jh16^2)*ro;    %y8

a37_1=((y1-y2)/jh1^2)*ro;   %x1
a37_2=(-(x1-x2)/jh1^2)*ro;  %y1
a37_3=(-(y1-y2/jh1^2))+((y3-y2)/jh3^2)*ro;  %x2
a37_4=(-(x1-x2)/jh1^2)-((x3-x2)/jh3^2)*ro;  %y2
a37_5=(-(y3-y2)/jh3^2)*ro;  %x3
a37_6=((x3-x2)/jh3^2)*ro;   %y3
a38_1=((y1-y2)/jh2^2)*ro;   %x1
a38_2=(-(x1-x2)/jh2^2)*ro;  %y1
a38_3=(-(y1-y2/jh2^2))+((y3-y2)/jh4^2)*ro;  %x2
a38_4=(-(x1-x2)/jh2^2)-((x3-x2)/jh4^2)*ro;  %y2
a38_5=(-(y3-y2)/jh4^2)*ro;  %x3
a38_6=((x3-x2)/jh4^2)*ro;   %y3

a41_3=((y2-y3)/jh3^2)*ro;   %x2
a41_4=(-(x2-x3)/jh3^2)*ro;  %y2
a41_5=(((y2-y3)/jh3^2)+((y4-y3)/jh5^2))*ro;     %x3
a41_6=((-(x2-x3)/jh3^2)-((x4-x3)/jh5^2))*ro;    %y3
a41_7=(-(y4-y3)/jh5^2)*ro;  %x4
a41_8=((x4-x3)/jh5^2)*ro;   %y4
a42_3=((y2-y3)/jh4^2)*ro;   %x2
a42_4=(-(x2-x3)/jh4^2)*ro;  %y2
a42_5=(((y2-y3)/jh4^2)+((y4-y3)/jh6^2))*ro;     %x3
a42_6=((-(x2-x3)/jh4^2)-((x4-x3)/jh6^2))*ro;    %y3
a42_7=(-(y4-y3)/jh6^2)*ro;  %x4
a42_8=((x4-x3)/jh6^2)*ro;   %y4

a45_5=((y3-y4)/jh5^2)*ro;   %x3
a45_6=(-(x3-x4)/jh5^2)*ro;  %y3
a45_7=((-(y3-y4)/jh5^2)+((y5-y4)/jh7^2))*ro;    %x4
a45_8=(((x3-x4)/jh5^2)-((x5-x4)/jh7^2))*ro;     %y4
a45_9=(-(y5-y4)/jh7^2)*ro;  %x5
a45_10=((x5-x4)/jh7^2)*ro;  %y5
a46_5=((y3-y4)/jh6^2)*ro;   %x3
a46_6=(-(x3-x4)/jh6^2)*ro;  %y3
a46_7=((-(y3-y4)/jh6^2)+((y5-y4)/jh8^2))*ro;    %x4
a46_8=(((x3-x4)/jh6^2)-((x5-x4)/jh8^2))*ro;     %y4
a46_9=(-(y5-y4)/jh8^2)*ro;  %x5
a46_10=((x5-x4)/jh8^2)*ro;  %y5

a49_7=((y4-y5)/jh7^2)*ro;   %x4
a49_8=(-(x4-x5)/jh7^2)*ro;  %y4
a49_9=((-(y4-y5)/jh7^2)+((y6-y5)/jh9^2))*ro;    %x5
```

```
a49_10=(((x4-x5)/jh7^2)-((x6-x5)/jh9^2))*ro;         %y5
a49_11=(-(y6-y5)/jh9^2)*ro; %x6
a49_12=((x6-x5)/jh9^2)*ro;  %y6
a50_7=((y4-y5)/jh8^2)*ro;   %x4
a50_8=(-(x4-x5)/jh8^2)*ro;  %y4
a50_9=((-(y4-y5)/jh8^2)+((y6-y5)/jh10^2))*ro;    %x5
a50_10=(((x4-x5)/jh8^2)-((x6-x5)/jh10^2))*ro;        %y5
a50_11=(-(y6-y5)/jh10^2)*ro;     %x6
a50_12=((x6-x5)/jh10^2)*ro; %y6

a53_9=((y5-y6)/jh9^2)*ro;   %x5
a53_10=(-(x5-x6)/jh9^2)*ro; %y5
a53_11=((-(y5-y6)/jh9^2)+((y7-y6)/jh11^2))*ro;  %x6
a53_12=(((x5-x6)/jh9^2)-((x7-x6)/jh11^2))*ro;   %y6
a53_13=(-(y7-y6)/jh11^2)*ro;     %x7
a53_14=((x7-x6)/jh11^2)*ro; %y7
a54_9=((y5-y6)/jh10^2)*ro;  %x5
a54_10=(-(x5-x6)/jh10^2)*ro;     %y5
a54_11=((-(y5-y6)/jh10^2)+((y7-y6)/jh12^2))*ro; %x6
a54_12=(((x5-x6)/jh10^2)-((x7-x6)/jh12^2))*ro;  %y6
a54_13=(-(y7-y6)/jh12^2)*ro;     %x7
a54_14=((x7-x6)/jh12^2)*ro; %y7

a57_11=((y6-y7)/jh11^2)*ro; %x6
a57_12=(-(x6-x7)/jh11^2)*ro;     %y6
a57_13=((-(y6-y7)/jh11^2)+((y8-y7)/jh13^2))*ro; %x7
a57_14=(((x6-x7)/jh11^2)-((x8-x7)/jh13^2))*ro;  %y7
a57_15=(-(y8-y7)/jh13^2)*ro;     %x8
a57_16=((x8-x7)/jh13^2)*ro; %y8
a58_11=((y6-y7)/jh12^2)*ro; %x6
a58_12=(-(x6-x7)/jh12^2)*ro;     %y6
a58_13=((-(y6-y7)/jh12^2)+((y8-y7)/jh14^2))*ro; %x7
a58_14=(((x6-x7)/jh12^2)-((x8-x7)/jh14^2))*ro;  %y7
a58_15=(-(y8-y7)/jh14^2)*ro;     %x8
a58_16=((x8-x7)/jh14^2)*ro; %y8

a61_1=(-(y1-y8)/jh15^2)*ro; %x1
a61_2=((x1-x8)/jh15^2)*ro;  %y1
a61_13=((y7-y8)/jh13^2)*ro; %x7
a61_14=(-(x7-x8)/jh13^2)*ro;     %y7
a61_15=((-(y7-y8)/jh13^2)+((y1-y8)/jh15^2))*ro;      %x8
a61_16=(((x7-x8)/jh13^2)-((x1-x8)/jh15^2))*ro;       %y8
a62_1=(-(y1-y8)/jh16^2)*ro; %x1
a62_2=((x1-x8)/jh16^2)*ro;  %y1
a62_13=((y7-y8)/jh14^2)*ro; %x7
a62_14=(-(x7-x8)/jh14^2)*ro;     %y7
a62_15=((-(y7-y8)/jh14^2)+((y1-y8)/jh16^2))*ro;      %x8
a62_16=(((x7-x8)/jh14^2)-((x1-x8)/jh16^2))*ro;       %y8

% Matriks A
A=[a1_1,a1_2,a1_3,a1_4,0,0,0,0,0,0,0,0,0,0,0,0;
    a2_1,a2_2,a2_3,a2_4,0,0,0,0,0,0,0,0,0,0,0,0;
    0,0,a5_3,a5_4,a5_5,a5_6,0,0,0,0,0,0,0,0,0,0;
    0,0,a6_3,a6_4,a6_5,a6_6,0,0,0,0,0,0,0,0,0,0;
    0,0,0,0,a9_5,a9_6,a9_7,a9_8,0,0,0,0,0,0,0,0;
    0,0,0,0,a10_5,a10_6,a10_7,a10_8,0,0,0,0,0,0,0,0;
    0,0,0,0,0,0,a13_7,a13_8,a13_9,a13_10,0,0,0,0,0,0;
```

```
    0,0,0,0,0,0,a14_7,a14_8,a14_9,a14_10,0,0,0,0,0,0;
    0,0,0,0,0,0,0,0,a17_9,a17_10,a17_11,a17_12,0,0,0,0;
    0,0,0,0,0,0,0,0,a18_9,a18_10,a18_11,a18_12,0,0,0,0;
    0,0,0,0,0,0,0,0,0,0,a21_11,a21_12,a21_13,a21_14,0,0;
    0,0,0,0,0,0,0,0,0,0,a22_11,a22_12,a22_13,a22_14,0,0;
    0,0,0,0,0,0,0,0,0,0,0,0,a25_13,a25_14,a25_15,a25_16;
    0,0,0,0,0,0,0,0,0,0,0,0,a26_13,a26_14,a26_15,a26_16;
    a29_1,a29_2,0,0,0,0,0,0,0,0,0,0,0,a29_15,a29_16;
    a30_1,a30_2,0,0,0,0,0,0,0,0,0,0,0,a30_15,a30_16;
    a33_1,a33_2,a33_3,a33_4,0,0,0,0,0,0,0,0,0,a33_15,a33_16;
    a34_1,a34_2,a34_3,a34_4,0,0,0,0,0,0,0,0,0,a34_15,a33_16;
    a37_1,a37_2,a37_3,a37_4,a37_5,a37_6,0,0,0,0,0,0,0,0,0;
    a38_1,a38_2,a38_3,a38_4,a38_5,a38_6,0,0,0,0,0,0,0,0,0;
    0,0,a41_3,a41_4,a41_5,a41_6,a41_7,a41_8,0,0,0,0,0,0,0;
    0,0,a42_3,a42_4,a42_5,a42_6,a42_7,a42_8,0,0,0,0,0,0,0;
    0,0,0,0,a45_5,a45_6,a45_7,a45_8,a45_9,a45_10,0,0,0,0,0;
    0,0,0,0,a46_5,a46_6,a46_7,a46_8,a46_9,a46_10,0,0,0,0,0;
    0,0,0,0,0,0,a49_7,a49_8,a49_9,a49_10,a49_11,a49_12,0,0,0,0;
    0,0,0,0,0,0,a50_7,a50_8,a50_9,a50_10,a50_11,a50_12,0,0,0,0;
    0,0,0,0,0,0,0,0,a53_9,a53_10,a53_11,a53_12,a53_13,a53_14,0,0;
    0,0,0,0,0,0,0,0,a54_9,a54_10,a54_11,a54_12,a54_13,a54_14,0,0;
    0,0,0,0,0,0,0,0,0,0,a57_11,a57_12,a57_13,a57_14,a57_15,a57_16;
    0,0,0,0,0,0,0,0,0,0,a58_11,a58_12,a58_13,a58_14,a58_15,a58_16;
    a61_1,a61_2,0,0,0,0,0,0,0,0,0,0,a61_13,a61_14,a61_15,a61_16;
    a62_1,a62_2,0,0,0,0,0,0,0,0,0,0,a62_13,a62_14,a62_15,a62_16];

disp ('A = ');
disp (A);
disp ('-----------------------------------------------');

% Matriks F
F=[jh1-ju1;
    jh2-ju2;
    jh3-ju3;
    jh4-ju4;
    jh5-ju5;
    jh6-ju6;
    jh7-ju7;
    jh8-ju8;
    jh9-ju9;
    jh10-ju10;
    jh11-ju11;
    jh12-ju12;
    jh13-ju13;
    jh14-ju14;
    jh15-ju15;
    jh16-ju16;
    (sh1-su1);
    (sh2-su2);
    (sh5-su5);
    (sh6-su6);
    (sh9-su9);
    (sh10-su10);
    (sh13-su13);
    (sh14-su14);
    (sh17-su17);
    (sh18-su18);
```

```
    (sh22-su22);
    (sh23-su23);
    (sh26-su26);
    (sh27-su27);
    (sh31-su31);
    (sh32-su32)];
disp ('F = ');
disp (F);
disp ('-----------------------------------------------');
%Matriks E
E=zeros((d),(0.5*n));
    E(1,1)=1;
    E(2,2)=1;
    E(3,1)=y1;
    E(3,2)=-x1;
    E(4,1)=x1;
    E(4,2)=y1;
    E(1,3)=1;
    E(2,4)=1;
    E(3,3)=y2;
    E(3,4)=-x2;
    E(4,3)=x2;
    E(4,4)=y2;
    E(1,5)=1;
    E(2,6)=1;
    E(3,5)=y3;
    E(3,6)=-x3;
    E(4,5)=x3;
    E(4,6)=y3;
    E(1,7)=1;
    E(2,8)=1;
    E(3,7)=y4;
    E(3,8)=-x4;
    E(4,7)=x4;
    E(4,8)=y4;
    E(1,9)=1;
    E(2,10)=1;
    E(3,9)=y5;
    E(3,10)=-x5;
    E(4,9)=x5;
    E(4,10)=y5;
    E(1,11)=1;
    E(2,12)=1;
    E(3,11)=y6;
    E(3,12)=-x6;
    E(4,11)=x6;
    E(4,12)=y6;
    E(1,13)=1;
    E(2,14)=1;
    E(3,13)=y7;
    E(3,14)=-x7;
    E(4,13)=x7;
    E(4,14)=y7;
    E(1,15)=1;
    E(2,16)=1;
    E(3,15)=y8;
    E(3,16)=-x8;
    E(4,15)=x8;
```

```
    E(4,16)=y8;
disp ('E = ');
disp (E);
disp ('-----------------------------------------------');
N = A'*P*A;
disp ('N = ');
disp (N);
disp ('-----------------------------------------------');
nn=inv(N+(E'*E));
G = A'*P*F;
disp ('G = ');
disp (G);
disp ('-----------------------------------------------');
X = nn * G
V = (A*X)-F

%matriks pendekatan
X0=[x1;y1;x2;y2;x3;y3;x4;y4;x5;y5;x6;y6;x7;y7;x8;y8];

Xa=X+X0;
%pendefinisian matriks Xa
x1=Xa(1,1);
y1=Xa(2,1);
x2=Xa(3,1);
y2=Xa(4,1);
x3=Xa(5,1);
y3=Xa(6,1);
x4=Xa(7,1);
y4=Xa(8,1);
x5=Xa(9,1);
y5=Xa(10,1);
x6=Xa(11,1);
y6=Xa(12,1);
x7=Xa(13,1);
y7=Xa(14,1);
x8=Xa(15,1);
y8=Xa(16,1);
end
disp('------------------------------');
dlmwrite('matriks_x2013.csv',X,'precision','%.8f','newline','pc')
type matriks_x2013.csv

disp('------------------------------');
dlmwrite('koordinat_titik_pantau2013.csv',Xa,'precision','%.8f','new
line','pc')
type koordinat_titik_pantau2013.csv

disp('------------------------------');
V=(A*X)-F;
disp('Matriks Residu (V)');
disp(V);

disp('------------------------------');
aposteriori=(V'*P*V)/((n-u)+d)
dlmwrite('aposteriori_2013.csv',aposteriori,'precision','%.40f','new
line','pc')
type aposteriori_2013.csv
```

```
disp('------------------------------');
sigmaxx=aposteriori*nn
dlmwrite('sigmaxx2013.csv',sigmaxx,'precision','%.30f','newline','pc
')
type sigmaxx2013.csv

disp('------------------------------');
dlmwrite('inv_apa2013.csv',nn,'precision','%.8f','newline','pc')
type inv_apa2013.csv

disp('------------------------------');
sigmavv=aposteriori*(inv(P)-(A*nn*A'));
sdV=diag(sigmavv).^(1/2);

sdX=diag(sigmaxx).^(1/2);
dlmwrite('sdX2013.csv',sdX,'precision','%.30f','newline','pc')
type sdX2013.csv


%proses uji global
   disp('uji global')
   varapri=1;
   postvarian=(aposteriori/varapri)
   if postvarian > 1.8432
   disp ('uji global Ho ditolak')
    elseif postvarian <= 1.8432
   disp ('uji global Ho diterima')
    end

   %proses uji snooping
  for i=1:n
    W(i)=V(i)/sdV(i);
  end


  disp('uji snooping')
  for i=1:n
uji_snooping = abs(W(i));
if uji_snooping <= 15.94723801
   disp ('uji snooping Ho diterima')
elseif uji_snooping > 15.94723801
   disp ('uji snooping Ho ditolak')
end
end
```

LAMPIRAN O

SCRIPT UJI KESEBANGUNAN JARING DAN UJI PERGESERAN TITIK

```
clc;
format long
%****panggil file data
fn=input('nama file data koordinat 2001 :','s');
data2001=xlsread(fn);
xo=data2001(:,1);
yo=data2001(:,2);
fn1=input('nama file data koordinat 1999 :','s');
data1999=xlsread(fn1);
xo1=data1999(:,1);
yo1=data1999(:,2);

%proses hitungan
m=length (xo);
for i=1:m
    dx((2*i)-1)=xo(i)-xo1(i);
    dy(2*i)=yo(i)-yo1(i);
end
%menghitung d
d=zeros((2*m),1);
d(1)=dx(1);
d(2)=dy(2);
d(3)=dx(3);
d(4)=dy(4);
d(5)=dx(5);
d(6)=dy(6);
d(7)=dx(7);
d(8)=dy(8);
d(9)=dx(9);
d(10)=dy(10);
d(11)=dx(11);
d(12)=dy(12);
d(13)=dx(13);
d(14)=dy(14);
d(15)=dx(15);
d(16)=dy(16);
disp ('d = ')
disp (d);

%menghitung Ud
Ud=zeros(16,32);
Ud(1,1)=1;
Ud(2,2)=1;
Ud(3,3)=1;
Ud(4,4)=1;
Ud(5,5)=1;
Ud(6,6)=1;
Ud(7,7)=1;
Ud(8,8)=1;
Ud(9,9)=1;
Ud(10,10)=1;
Ud(11,11)=1;
Ud(12,12)=1;
Ud(13,13)=1;
Ud(14,14)=1;
Ud(15,15)=1;
Ud(16,16)=1;
```

```
Ud(1,17)=-1;
Ud(2,18)=-1;
Ud(3,19)=-1;
Ud(4,20)=-1;
Ud(5,21)=-1;
Ud(6,22)=-1;
Ud(7,23)=-1;
Ud(8,24)=-1;
Ud(9,25)=-1;
Ud(10,26)=-1;
Ud(11,27)=-1;
Ud(12,28)=-1;
Ud(13,29)=-1;
Ud(14,30)=-1;
Ud(15,31)=-1;
Ud(16,32)=-1;

%ngitung Q 2012 dan Q 2013
a=dlmread('inv_apa1999.csv');
u=m*2;
for i=1:u
    q2(1,i)=a(1,i);
    q2(2,i)=a(2,i);
    q2(3,i)=a(3,i);
    q2(4,i)=a(4,i);
    q2(5,i)=a(5,i);
    q2(6,i)=a(6,i);
    q2(7,i)=a(7,i);
    q2(8,i)=a(8,i);
    q2(9,i)=a(9,i);
    q2(10,i)=a(10,i);
    q2(11,i)=a(11,i);
    q2(12,i)=a(12,i);
    q2(13,i)=a(13,i);
    q2(14,i)=a(14,i);
    q2(15,i)=a(15,i);
    q2(16,i)=a(16,i);

end
b=dlmread('inv_apa2001.csv');
u=m*2;
for i=1:u
    q3(1,i)=b(1,i);
    q3(2,i)=b(2,i);
    q3(3,i)=b(3,i);
    q3(4,i)=b(4,i);
    q3(5,i)=b(5,i);
    q3(6,i)=b(6,i);
    q3(7,i)=b(7,i);
    q3(8,i)=b(8,i);
    q3(9,i)=b(9,i);
    q3(10,i)=b(10,i);
    q3(11,i)=b(11,i);
    q3(12,i)=b(12,i);
    q3(13,i)=b(13,i);
    q3(14,i)=b(14,i);
```

```
    q3(15,i)=b(15,i);
    q3(16,i)=b(16,i);

end

%ngitung Qd
Qd=zeros((2*u),(2*u));

for i=1:u
Qd(1,i)=q3(1,i);
Qd(2,i)=q3(2,i);
Qd(3,i)=q3(3,i);
Qd(4,i)=q3(4,i);
Qd(5,i)=q3(5,i);
Qd(6,i)=q3(6,i);
Qd(7,i)=q3(7,i);
Qd(8,i)=q3(8,i);
Qd(9,i)=q3(9,i);
Qd(10,i)=q3(10,i);
Qd(11,i)=q3(11,i);
Qd(12,i)=q3(12,i);
Qd(13,i)=q3(13,i);
Qd(14,i)=q3(14,i);
Qd(15,i)=q3(15,i);
Qd(16,i)=q3(16,i);

end

Qd(17,(17:32))=q2(1,(1:16));
Qd(18,(17:32))=q2(2,(1:16));
Qd(19,(17:32))=q2(3,(1:16));
Qd(20,(17:32))=q2(4,(1:16));
Qd(21,(17:32))=q2(5,(1:16));
Qd(22,(17:32))=q2(6,(1:16));
Qd(23,(17:32))=q2(7,(1:16));
Qd(24,(17:32))=q2(8,(1:16));
Qd(25,(17:32))=q2(9,(1:16));
Qd(26,(17:32))=q2(10,(1:16));
Qd(27,(17:32))=q2(11,(1:16));
Qd(28,(17:32))=q2(12,(1:16));
Qd(29,(17:32))=q2(13,(1:16));
Qd(30,(17:32))=q2(14,(1:16));
Qd(31,(17:32))=q2(15,(1:16));
Qd(32,(17:32))=q2(16,(1:16));


%menghitung K dan Vd
K=(inv(Ud*Qd*Ud'))*d
Vde=(Qd*-1)*Ud'*K;
Vd=inv(Qd)*Vde;

%ngitung apriori dan aposteriori pergeseran
varapos1999=dlmread('aposteriori_1999.csv');
varapos2001=dlmread('aposteriori_2001.csv');
apriori_pergeseran=(varapos1999+varapos2001)/2
b=sqrt(apriori_pergeseran);
```

```
r=16;
varapos_pergeseran=(Vd'*(inv(Qd))*Vd)/r

%uji kesebangunan jaring
disp('uji kesebangunan jaring')
uji_global = varapos_pergeseran/apriori_pergeseran
if uji_global <= 2.0096
   disp ('uji global diterima')
elseif uji_global > 2.0096
   disp ('uji global ditolak')
end

%ngitung Nd dan Wdi
Nd=Ud'*(inv(Ud*Qd*Ud'))*Ud;

z=pinv(Qd);
for i=1:32
    s(i,i)=z(i,i);
end

for i=1:32
    Wd(i,1)=s(i,i)*Vd(i,1)/(b*(sqrt(Nd(i,i))));
end
disp('nilai Wd setiap koordinat pada kala 1999 dan 2001')
disp(Wd(1:32,1))

%uji pergeseran titik
disp('uji pergeseran titik')
for i=1:(4*m)
uji_snooping(i) = abs(Wd(i));
if uji_snooping(i) <= 2.0096
   disp ('uji snooping diterima')
elseif uji_snooping(i) > 2.0096
   disp ('uji snooping ditolak')
end
end
```

LAMPIRAN P

SCRIPT UJI SIGNIFIKANSI PARAMETER

```
clc;
clear;
format long g;
n =16;
u =16;
d =4;

k=dlmread('koordinat_titik_pantau1999.csv',';');
t=16;
for i=1:t
    a(i,1)=k(i,1);
end
disp('koordinat titik pantau tahun 1999=');
disp(a);

l=dlmread('koordinat_titik_pantau2001.csv',';');
u=16;
for i=1:u
    b(i,1)=l(i,1);
end
disp('koordinat titik pantau tahun 2001=');
disp(b);

m=dlmread('sigmaxx1999.csv');
v=16;
for i=1:v
    c(i,1)=m(i,i);
end

n=dlmread('sigmaxx2001.csv');
w=16;
for i=1:w
    d(i,1)=n(i,i);
end

for i=1:16
    e(i,1)=c(i,1)+d(i,1);
end
disp(e);
f=sqrt(e)
g=a-b

for i=1:16
    h(i,1)=g(i,1)/f(i,1);
end
j=abs(h)

for i=1:16
    uji_signifikansi = j(i);
   if  uji_signifikansi <= 2.13185
       disp ('titik tidak bergeser secara signifikan')
   elseif uji_signifikansi > 2.13185
       disp ('titik bergeser secara signifikan')
   end
end
```

LAMPIRAN Q

NILAI KOMPONEN VARIAN SUDUT DAN JARAK UNTUK MASING-MASING ALAT UKUR

Lampiran komponen varian sudut untuk masing-masing alat ukur

Jenis alat	σ_{C1}	σ_{C2}	σ_{C3}	d	M	σ_T^2
Sokkisha TM1A	0,5	0,5	0,5	1”	30	0,5
Topcon DT 200 series	0,5	0,5	0,5	20”	30	0,5
Nikon DTM 352	0,5	0,5	0,5	20”	30	0,5

Lampiran komponen varian jarak untuk masing-masing alat ukur

Jenis alat	a^2	b^2
Sokkisha TM1A	1	2
Topcon DT 200 series	5	5
Nikon DTM 352	3	3