

CIRCUM: Notes on usage.

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CIRCUM is a computer program for fitting circumplex models described in Browne (1992; referred to henceforth as B92). It consists of satellite subroutines for evaluating both the models and appropriate derivatives appended to AUFIT, a general computer program for fitting nonstandard models described in Browne & Du Toit (1992).

On the accompanying diskette there is a file CIRCUM.EXE and some input files. Particular attention will be given here to the specimen input file GFM3EC.DAT. This may be copied to directories on the hard disk of your computer. To run the program enter CIRCUM and provide the names of the input and output files when requested to do so. If you wish to terminate iteration before the convergence requirement has been attained, depress Ctrl-Break simultaneously while iteration details are being printed out on the screen (i.e. after iteration has started and before it has been terminated.) If you type Y when asked whether you wish to terminate iteration, iteration will stop and all results obtained will be written to the output file.

After you have run the example provided you may want to explore the capabilities of the program by copying the input file to another file, make changes to it and run the program again using the changed file. Here is a listing of the input file, GFM3EC.DAT (**G**urtman data; **F**ourier series correlation function, No. of free parameters, m , = **3**; **E**qual **C**ommunality Indices). Paragraph numbers (e.g. #1) have been added for reference purposes.

```
#1 | PROG AUFIT MODE=CORR DISCREP=ML MAXITER=500 CONVERGE=0.0001;
#2 | VARNAMES = LM NO PA BC DE FG HI JK ;
#3 | NCASES = 1093 ;
#4 | TITLE=Gurtman 10/9/95 - Fourier correlation fn. m=3, equal comm.;
#5 | SCORR =
    | 1.000
    | .546 1.000
    | .358 .594 1.000
    | .234 .425 .683 1.000
    | .336 .243 .450 .631 1.000
    | .401 .206 .330 .512 .678 1.000
    | .496 .270 .184 .326 .492 .714 1.000
    | .725 .423 .220 .234 .356 .504 .706 1.000 ;
#6 | /*
#7 | 2 3 1 1 1 2 1 1 0 (ITYPE, NBET, IREF, IRIV, INDSET, ITUPS, ITTHE, INDER, IRHO)
```

Please note that paragraphs #1..#5 all terminate with semicolons, ;. AUFIT will not run correctly if any of the 5 semicolons are omitted. Semicolons are not required for line #6 and line #7 (Input specific to CIRCUM). Only the first 80 columns in any line (paragraph) are read by the program.

Individual sections of the input file will now be described.

Paragraph #1.

PROG AUFIT ... ;

Program paragraph. Changes to MODE=, MAXITER=, and CONVERGE= are not recommended. Possible alternatives for ML (Maximum likelihood) in DISCREP= (discrepancy function =) are OLS (Ordinary least squares) and GLS (Normal theory generalized least squares). ML is the preferred option. (Note a high maximum number of iterations has no disadvantages because of the Ctrl-Break termination option described earlier.)

Paragraph #2.

VARNAMES = ... ;

Provides names for manifest variables. These should appear in the same order as that used for the correlation matrix (Paragraph #5). The list may continue on the following lines if necessary (See the file REVCIRC.DAT on your diskette).

Paragraph #3.

NCASES = ... ;

Provides the sample size. This must be specified.

Paragraph #4.

TITLE = ... ;

Provides a title which is printed out in the output file. It is advisable to change this title whenever options are changed so that output is correctly identified.

Paragraph #5.

SCORR = ...
... ;

Lower triangular half of the sample correlation matrix fed in row wise. Rows that require more than one line may be continued on the next line (See the file REVCIRC.DAT on your diskette)

Line #6.

/*

This line indicates the end of standard AUFIT input and the beginning of the specific CIRCUM input. It remains constant from one job to another. Spacing is unimportant but the two symbols /* must be contiguous.

Line #7.

2 3 1 1 1 2 1 1 0 (ITYPE, NBET, IREF IRIV, INDSET, ITUPS ITTHE, INDER, IRHO)

This consists of 9 numbers separated by blanks that act as specific control codes for the CIRCUM satellite routines. Spacing is unimportant. Text after the 9th number is disregarded.

2	3	1	1	1	2	1	1	0
ITYPE	NBET	IREF	IRIV	INDSET	ITUPS	ITTHE	INDER	IRHO
#1	#2	#3	#4	#5	#6	#7	#8	#9

ITYPE = 1 Anderson correlation function. (B92, formula (18))
= 2 Fourier correlation function. (B92, formula (30))

NBET = $m (\geq 1)$ = Number of free parameters in the Fourier correlation function (B92, formula (30)).
Must = 0 or 1 for the Anderson correlation function.
NBET = 0 $\Rightarrow \lambda = 1.7 \Rightarrow \rho_{180^\circ} = 0.01$ (B92 p. 480). 1 is the standard option for the Anderson correlation function.

IREF = Number of the reference variable with its polar angle = 0. (B92, Section 5.2) Usually (but not necessarily) = 1 for the first variable.

IRIV = 1[†] Initial approximations are calculated in the program from a Factor Analysis (B92, Section 6.7).
= 2 Initial approximations are provided by the user and read in.

INDSET = 1[†] Parameter equalities and fixed values are set by the program.
= 2 Parameter equalities and fixed values are provided by the user in an array INDPAR read by the program.

ITUPS = 1 Communalities indices are unconstrained.
= 2 Communalities indices are constrained to be equal
= 3 Communalities indices are constrained to be = 1.

ITTHE = 1 Polar angles, θ_i , are unconstrained.
= 2 Polar angles, θ_i , are equally spaced about 360°. (Equally Spaced Circumplex; Circulant: B92, Section 6.2)
= 3 Polar angles, θ_i , are equally spaced about 180°. (Equally Spaced Simplex; Toeplitz matrix)

INDER = 0 Numerical approximations for derivatives are employed in computations.
= 1[†] Exact analytic derivatives are employed in computations.

IRHO = 0 No constraints on the minimal correlation ρ_{180° (B92, formulae (33) and (20)) (Compulsory if ITYPE = 1)
= 1 $\rho_{180^\circ} = 0$ (Only with ITYPE = 2)
= 2 $\rho_{180^\circ} = -1$ (Only with ITYPE = 2)

[†] Recommended for routine use

If IRIV = 1 and INDSET = 1 (as will be the case in most analyses) a single line follows the /* line. If not some additional lines are required.

IF(INDSET = 2) the integer array INDPAR(I), I=1,NPARMS must follow the control codes on a new line

IF(IRIV = 2) or IF(ITYPE = 1 and NBET = 0) the real array GAMMA(I), I=1,NPARMS must follow INDPAR on a new line

The order of parameters required for GAMMA and INDPAR is:

1 ... NV	: ZETA (Scaling factors, ζ_{ii} . Nuisance parameters, B92, p. 471, last 2 lines)
NV+1 ... 2*NV	: THETA (Polar angles, θ_i)
2*NV+1 ... 3*NV	: UPS (v_{ii} , used for calculating communality indices $\rho(x_i, c_i)$ (B92, formula (4)).
3*NV+1 ... 3*NV+NBET	: ALPHA (Correlation Function parameters, α_j , used to construct the β_i with : $\beta_i = \alpha_i / \sum_{j=0}^m \alpha_j$ where $\alpha_1 = 1$, fixed. Consequently $\sum_{i=0}^m \beta_i = 1$.

This is the order in which parameter values are printed out in the output headed "ESTIMATES OF UNKNOWN PARAMETERS".

An annotated output file, GFM3EC.OUT is appended to explain output.

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 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

Fourier m=3 Standard choice Standard choice Standard choice
 ITYPE = 2 NBET = 3 IREF = 1 IRIV = 1 INDSET = 1

Equal communalities Unconstrained angles Standard choice No constraint on rho at 180 degrees
 ITUPS = 2 ITTHE = 1 INDER = 1 IRHO = 0

.....
 • UNROTATED ROW SCALED FACTOR MATRIX • Factor analysis and rotation employed for
 initial approximations: B92 Section 6.7

	1	2	3
1	0.9216	-0.3752	-0.0998
2	0.8354	0.1297	-0.5341
3	0.7113	0.5952	-0.3739
4	0.6006	0.7992	0.0232
5	0.7472	0.5435	0.3825
6	0.7642	0.2965	0.5727
7	0.7905	-0.0426	0.6110
8	0.8785	-0.3106	0.3630

.....
 • ROTATED ROW SCALED FACTOR MATRIX •

	1	2	3
1	0.3483	-0.4682	0.8121
2	-0.3230	-0.4645	0.8246
3	-0.5832	-0.0286	0.8118
4	-0.4923	0.4195	0.7626
5	-0.0465	0.5058	0.8614
6	0.2638	0.4914	0.8300
7	0.5450	0.3022	0.7821
8	0.5956	-0.0695	0.8002

TOTAL INTEGER CORE STORAGE REQUIRED = 175
 TOTAL REAL CORE STORAGE REQUIRED = 1917
 TOTAL CHAR. CORE STORAGE REQUIRED = 37

.....
 • INITIAL APPROXIMATIONS : •

	z - LM z = zeta = nuisance parameters	z - NO	z - PA	z - BC	z - DE
INITIAL	0.95836	0.79186	0.80690	0.94764	0.74287
	z - FG	z - HI	z - JK	Θ - LM	Θ - NO
INITIAL	0.76858	0.78970	0.88075	0.00000	71.46738
	Θ - PA Θ = theta=polar angle	Θ - BC	Θ - DE	Θ - FG	Θ - HI
INITIAL	123.83950	167.08316	211.39026	244.87721	277.63828
	Θ - JK	u - LM	u - NO u = upsilon = unique variance B92 p.471	u - PA	u - BC
INITIAL	313.30243	0.46632	0.46632	0.46632	0.46632
	u - DE	u - FG	u - HI	u - JK	α_0
INITIAL	0.46632	0.46632	0.46632	0.46632	1.91618
	α_2	α_3	α 's are used to obtain betas		
INITIAL	0.00000	0.00000			

.....
 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

Details of Iterations

• Iter •	• Method •	• Discr. •	• Funct. •	• Max.R.Cos. •	• Max.Const. •	• NRP •	NBD •	• Seconds •
• 1(0) •	• ML •	• 0.55829736 •	• 0.424740 •	• 0.000000 •	• 0 •	0 •	• 0.8 •	
• 2(0) •	• ML •	• 0.13483059 •	• 0.389895 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 3(0) •	• ML •	• 0.08481329 •	• 0.319908 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 4(0) •	• ML •	• 0.07098295 •	• 0.112855 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 5(0) •	• ML •	• 0.06694383 •	• 0.088421 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 6(0) •	• ML •	• 0.06596897 •	• 0.026109 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 7(0) •	• ML •	• 0.06575362 •	• 0.017925 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 8(0) •	• ML •	• 0.06570867 •	• 0.006304 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 9(0) •	• ML •	• 0.06569912 •	• 0.003600 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 10(0) •	• ML •	• 0.06569711 •	• 0.001431 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 11(0) •	• ML •	• 0.06569668 •	• 0.000739 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 12(0) •	• ML •	• 0.06569659 •	• 0.000315 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 13(0) •	• ML •	• 0.06569657 •	• 0.000154 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 14(0) •	• ML •	• 0.06569657 •	• 0.000068 •	• 0.000000 •	• 0 •	0 •	• 0.7 •	
• 15(0) •	• ML •	• 0.06569657 •	• 0.000032 •	• 0.000000 •	• 0 •	0 •	• 0.9 •	

Convergence criterion
 Must be < epsilon twice

NRP=No. of redundant parameters
 NBD=No. of parameters on bounds

NUMBER OF OBSERVATIONS =1093
 NUMBER OF VARIABLES = 8
 NUMBER OF GROUPS = 1
 NUMBER OF FREE PARAMETERS = 19
 NUMBER OF FIXED PARAMETERS = 1
 NUMBER OF EQUALITY CONSTRAINTS = 0
 NUMBER OF ACTIVE INEQUALITY CONSTRAINTS = 0
 NUMBER OF ACTIVE BOUNDS = 0
 CONVERGENCE TOLERANCE FOR RESIDUAL COSINE = 0.000100 = epsilon

.....
 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

AUFIT output repeated later in a more convenient form

.....
 • ESTIMATES OF UNKNOWN PARAMETERS : •

	z-LM	z-NO	z-PA	z-BC	z-DE
ESTIM :	0.91668	0.89796	0.88739	0.89823	0.91421
S.E. :	0.02027	0.01954	0.01928	0.01947	0.02023

	z-FG	z-HI	z-JK	Θ -LM	Θ -NO
ESTIM :	0.92559	0.93027	0.92597	0.00000	69.80176
S.E. :	0.02073	0.02111	0.02075	0.00000	2.95230

	Θ -PA	Θ -BC	Θ -DE	Θ -FG	Θ -HI
ESTIM :	129.00231	172.38233	225.26934	264.03503	295.24002
S.E. :	3.03106	2.90794	2.96836	2.92841	2.71405

	Θ -JK	u-LM	u-NO	u-PA	u-BC
ESTIM :	328.58638	0.21076	0.21076	0.21076	0.21076
S.E. :	2.08442	0.01174	0.01174	0.01174	0.01174

	u-DE	u-FG	u-HI	u-JK	α_0
ESTIM :	0.21076	0.21076	0.21076	0.21076	1.73059
S.E. :	0.01174	0.01174	0.01174	0.01174	0.09911

	α_2	α_3
ESTIM :	0.11160	0.11799
S.E. :	0.01099	0.01110

NOTE: CORRECTIONS FOR STOCHASTIC STANDARDISATIONS HAVE NOT BEEN IMPOSED
 AND SHOULD BE APPLIED BY USER Disregard

If any α is less than zero reduce m and run CIRCUM again $\alpha=0$ implies beta = 0

.....
 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

See Browne & Cudeck 1992. Reference in B92 on p. 496

.....
 • MAXIMUM LIKELIHOOD DISCREPANCY FUNCTION : •

.....
 • MEASURES OF FIT OF THE MODEL •

SAMPLE DISCREPANCY FUNCTION VALUE : 0.066 (0.656966E-01)

POPULATION DISCREPANCY FUNCTION VALUE, Fo : 0.050
 BIAS ADJUSTED POINT ESTIMATE : (0.030 ; 0.078)
 90 PERCENT CONFIDENCE INTERVAL

ROOT MEAN SQUARE ERROR OF APPROXIMATION
 Steiger-Lind : RMSEA = SQRT(Fo/DF)
 POINT ESTIMATE : 0.054
 90 PERCENT CONFIDENCE INTERVAL : (0.042 ; 0.068)

EXPECTED CROSS-VALIDATION INDEX
 POINT ESTIMATE (MODIFIED AIC) : 0.100
 90 PERCENT CONFIDENCE INTERVAL : (0.080 ; 0.128)
 CVI (MODIFIED AIC) FOR THE SATURATED MODEL : 0.066

TEST STATISTIC : 71.74

EXCEEDANCE PROBABILITIES:-
 Ho: PERFECT FIT (RMSEA = 0.0) : 0.000
 Ho: CLOSE FIT (RMSEA .LE. 0.050) : 0.272

MULTIPLIER FOR OBTAINING TEST STATISTIC = 1092.0

DEGREES OF FREEDOM = 17

EFFECTIVE NUMBER OF PARAMETERS = 19

Primarily of theoretical interest. Disregard

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• GENERALISED LEAST SQUARES DISCREPANCY FUNCTION : •
.....

.....
• MEASURES OF FIT OF THE MODEL •
.....

SAMPLE DISCREPANCY FUNCTION VALUE : 0.065 (0.649614E-01)

POPULATION DISCREPANCY FUNCTION VALUE, Fo
BIAS ADJUSTED POINT ESTIMATE : 0.049
90 PERCENT CONFIDENCE INTERVAL : (0.029 ; 0.077)

ROOT MEAN SQUARE ERROR OF APPROXIMATION
Steiger-Lind : RMSEA = SQRT(Fo/DF)
POINT ESTIMATE : 0.054
90 PERCENT CONFIDENCE INTERVAL : (0.041 ; 0.067)

EXPECTED CROSS-VALIDATION INDEX
POINT ESTIMATE (MODIFIED AIC) : 0.100
90 PERCENT CONFIDENCE INTERVAL : (0.079 ; 0.127)
CVI (MODIFIED AIC) FOR THE SATURATED MODEL : 0.066

TEST STATISTIC : 70.94

EXCEEDANCE PROBABILITIES:-

Ho: PERFECT FIT (RMSEA = 0.0) : 0.000

Ho: CLOSE FIT (RMSEA .LE. 0.050) : 0.289

MULTIPLIER FOR OBTAINING TEST STATISTIC = 1092.0

DEGREES OF FREEDOM = 17

EFFECTIVE NUMBER OF PARAMETERS = 19

This information is output by AUFIT. CIRCUM repeats it later to 2 decimal places for clarity and variables are resorted if necessary.

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 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

.....
 • SAMPLE CORRELATION MATRIX : •

	LM	NO	PA	BC	DE	FG
LM	1.000					
NO	0.546	1.000				
PA	0.358	0.594	1.000			
BC	0.234	0.425	0.683	1.000		
DE	0.336	0.243	0.450	0.631	1.000	
FG	0.401	0.206	0.330	0.512	0.678	1.000
HI	0.496	0.270	0.184	0.326	0.492	0.714
JK	0.725	0.423	0.220	0.234	0.356	0.504

	HI	JK
HI	1.000	
JK	0.706	1.000

.....
 • REPRODUCED CORRELATION MATRIX : •

	LM	NO	PA	BC	DE	FG
LM	1.000					
NO	0.527	1.000				
PA	0.330	0.578	1.000			
BC	0.206	0.414	0.666	1.000		
DE	0.310	0.240	0.433	0.612	1.000	
FG	0.434	0.216	0.309	0.447	0.693	1.000
HI	0.550	0.310	0.215	0.351	0.526	0.734
JK	0.733	0.418	0.227	0.238	0.412	0.551

	HI	JK
HI	1.000	
JK	0.723	1.000

.....
 • RATIOS OF REPRODUCED VARIANCES TO INPUT VARIANCES : •

These ratios will be close to 1 if the model fits well.

LM	NO	PA	BC	DE	FG
1.017	0.976	0.953	0.977	1.012	1.037
HI	JK				
1.048	1.038				

.....
 • RESIDUAL MATRIX (CORRELATIONS) : •

	LM	NO	PA	BC	DE	FG
LM	0.0000					
NO	0.0192	0.0000				
PA	0.0279	0.0160	0.0000			
BC	0.0280	0.0109	0.0168	0.0000		
DE	0.0262	0.0029	0.0174	0.0189	0.0000	
FG	-0.0325	-0.0096	0.0213	0.0654	-0.0145	0.0000
HI	-0.0541	-0.0404	-0.0307	-0.0252	-0.0341	-0.0198
JK	-0.0078	0.0050	-0.0070	-0.0041	-0.0559	-0.0471
	HI	JK				
HI	0.0000					
JK	-0.0165	0.0000				

.....
 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

The most important output (by CIRCUM) starts here .

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 • PARAMETER ESTIMATES WITH APPROXIMATE 95% ONE AT A TIME CONFIDENCE INTERVALS •

.....
 • POLAR ANGLES •

	LM	NO	PA	BC	DE	FG
ESTIMATE	0.	70.	129.	172.	225.	264.
L. BOUND	0.	64.	123.	167.	219.	258.
U. BOUND	0.	76.	135.	178.	231.	270.

Repeat of Θ s given in AUFIT ouput rounding off decimals for clarity.
 Confidence intervals reflect precision of estimates.

	HI	JK
ESTIMATE	295.	329.
L. BOUND	290.	325.
U. BOUND	301.	333.

.....
 • COMMUNALITY INDICES • B92 formula (4). Constrained to be equal in the present example.

	LM	NO	PA	BC	DE	FG
ESTIMATE	0.91	0.91	0.91	0.91	0.91	0.91
L. BOUND	0.90	0.90	0.90	0.90	0.90	0.90
U. BOUND	0.92	0.92	0.92	0.92	0.92	0.92

	HI	JK
ESTIMATE	0.91	0.91
L. BOUND	0.90	0.90
U. BOUND	0.92	0.92

.....
 • ESTIMATES OF BETAS • Use to plot the correlation function. B92 formula (34) and fig. 6

0.5846 0.3378 0.0377 0.0399

MINIMUM COMMON SCORE CORRELATION = $\overset{\text{B92 formula (33)}}{0.245}$ (AT 180 DEGREES SEPARATION)

.....
 • Gurtman (10/9/95) - Fourier correlation fn. m=3, equal communalities •

Repeated here by CIRCUM to 2 places. Variables are resorted according to polar angles (if necessary).

.....
 • SAMPLE CORRELATION MATRIX •

	LM	NO	PA	BC	DE	FG
LM	1.00					
NO	0.55	1.00				
PA	0.36	0.59	1.00			
BC	0.23	0.42	0.68	1.00		
DE	0.34	0.24	0.45	0.63	1.00	
FG	0.40	0.21	0.33	0.51	0.68	1.00
HI	0.50	0.27	0.18	0.33	0.49	0.71
JK	0.72	0.42	0.22	0.23	0.36	0.50

	HI	JK
HI	1.00	
JK	0.71	1.00

.....
 • REPRODUCED OBSERVED SCORE CORRELATION MATRIX •

	LM	NO	PA	BC	DE	FG
LM	1.00					
NO	0.53	1.00				
PA	0.33	0.58	1.00			
BC	0.21	0.41	0.67	1.00		
DE	0.31	0.24	0.43	0.61	1.00	
FG	0.43	0.22	0.31	0.45	0.69	1.00
HI	0.55	0.31	0.21	0.35	0.53	0.73
JK	0.73	0.42	0.23	0.24	0.41	0.55

	HI	JK
HI	1.00	
JK	0.72	1.00

.....
 • REPRODUCED COMMON SCORE CORRELATION MATRIX •

	LM	NO	PA	BC	DE	FG
LM	1.00					
NO	0.64	1.00				
PA	0.40	0.70	1.00			
BC	0.25	0.50	0.81	1.00		
DE	0.38	0.29	0.52	0.74	1.00	
FG	0.52	0.26	0.37	0.54	0.84	1.00
HI	0.67	0.38	0.26	0.43	0.64	0.89
JK	0.89	0.51	0.27	0.29	0.50	0.67

	HI	JK
HI	1.00	
JK	0.87	1.00

.....
 • RESIDUAL MATRIX • Use to assess model fit.

	LM	NO	PA	BC	DE	FG
LM	0.00					
NO	0.02	0.00				
PA	0.03	0.02	0.00			
BC	0.03	0.01	0.02	0.00		
DE	0.03	0.00	0.02	0.02	0.00	
FG	-0.03	-0.01	0.02	0.07	-0.01	0.00
HI	-0.05	-0.04	-0.03	-0.03	-0.03	-0.02
JK	-0.01	0.00	-0.01	0.00	-0.06	-0.05

	HI	JK
HI	0.00	
JK	-0.02	0.00

.....
 • SUMS OF RESIDUALS • Diagnostics used for detecting variables that are responsible for lack of fit..

	LM	NO	PA	BC	DE	FG
SIGNED	0.00	0.02	0.04	0.06	0.07	0.03
ABSOLUTE	0.00	0.02	0.04	0.06	0.07	0.14

	HI	JK
SIGNED	-0.20	-0.13
ABSOLUTE	0.20	0.14

Diagnostics used to detect systematic lack of fit of the correlation function.

.....
 • SORTED RESIDUALS AND CORRELATION FUNCTION VALUES •

	1	2	3	4	5	6
ANG.DIF.	31.20	31.41	33.35	38.77	43.38	52.89
RESIDUAL	-0.02	-0.01	-0.02	-0.01	0.02	0.02
RHO	0.89	0.89	0.87	0.84	0.81	0.74

	7	8	9	10	11	12
ANG.DIF.	59.20	64.55	64.76	69.80	69.97	91.65
RESIDUAL	0.02	-0.05	-0.05	0.02	-0.03	0.07
RHO	0.70	0.67	0.67	0.64	0.64	0.54

	13	14	15	16	17	18
ANG.DIF.	95.96	96.27	101.22	102.58	103.32	122.86
RESIDUAL	-0.03	0.02	0.00	0.01	-0.06	-0.03
RHO	0.52	0.52	0.51	0.50	0.50	0.43

	19	20	21	22	23	24
ANG.DIF.	129.00	134.56	134.73	135.03	155.47	156.20
RESIDUAL	0.03	-0.04	0.03	0.02	0.00	0.00
RHO	0.40	0.38	0.38	0.37	0.29	0.29

	25	26	27	28
ANG.DIF.	160.42	165.77	166.24	172.38
RESIDUAL	-0.01	-0.01	-0.03	0.03
RHO	0.27	0.26	0.26	0.25

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 • CPU TIME (SECONDS) : 12.63 •
