EDDY CURRENT TEST PATTERN
RECOGNITION PROGRAM

NOVEMBER 1968

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UNITED STATES ATOMIC ENERGY COMMISSION UNDER CONTRACT AT(45-1)-1830

3 3679 00061 2137

BNWL-942

UC-37, Instruments

EDDY CURRENT TEST PATTERN RECOGNITION PROGRAM

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November 1968

FIRST UNREPRODUCED
DISTRIBUTION MADE

DEC 27 '68

BATTELLE MEMORIAL INSTITUTE
PACIFIC NORTHWEST LABORATORY
RICHLAND, WASHINGTON

Printed in the United States of America
Available from
Clearinghouse for Federal Scientific and Technical Information
National Bureau of Standards, U. S. Department of Commerce
Springfield, Virginia 22151
Price: Printed Copy \$3.00; Microfiche \$0.65

EDDY CURRENT TEST PATTERN RECOGNITION PROGRAM

ABSTRACT

The size and shape of a test pattern generated by an "eddy current" probe passing a flaw defect in metal tubing presents an opportunity to classify flaw patterns using automated techniques. The first step in this direction was the development of a mathematical model making use of the first two statistical moments to correlate an unknown pattern with a standard set of known patterns. Twelve of the 20 patterns selected at random were identified with the standard set of 23 patterns. The accumulation of experience with this process will lead to an improved set of standard patterns and consequent improvement in random pattern identification. The ultimate goal of this program will be the development of a test box for field use which will be used for "eddy current" incipient failure testing.

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EDDY CURRENT TEST PATTERN RECOGNITION PROGRAM

R. N. Ord and R. L. Richardson

INTRODUCTION

The detection of flaw defects in metals using eddy current test equipment has become a routine procedure for such members as heat exchanger tubing, fuel sheath tubing, and many others. The most advanced single frequency eddy current test equipment systems presently in use provide a readout composed of two variable dc voltages which form a complicated pattern (generally of figure eight shape) when presented on an X-Y oscilloscope. A continuous relationship exists between the shape and size of the patterns and the location and magnitude of the defects. The interpretation of test results is presently limited to the operator's ability to recognize this relationship supplemented by simple level sensing reject circuits. Quality assurance decisions, which are dependent upon the educated judgment and memory of different operators, suffer from a lack of uniformity. This is presently the limiting factor in improving the reproducibility of eddy current defect detection tests.

This report describes a method of test procedure simplification which will substitute computerized pattern recognition for human pattern recognition. This has been brought about partially by the need for uniform, high quality standards that will be necessary to produce the metal products for the successful development, construction, and operation of new reactor concepts such as the liquid metal fast breeder reactor.

SUMMARY AND CONCLUSIONS

The ability to mathematically recognize and classify eddy current patterns has been demonstrated in this study. Of 20 patterns selected at random, twelve were identified with the set of 23 "standard patterns".

The failure to identify eight of the 20 patterns selected at random would appear to be intolerable. However, the quality of these patterns was purposely chosen to make detection difficult. At the outset, no statistical error structure was available to help define the term "standard patterns". The procedure given in the body of the report is the initial phase of a program which will define standard patterns, perhaps eliminating those already chosen and adding new standard patterns which are found to be more frequently encountered. The process variables of linearity and gain offer no difficulty. However, some patterns must go unrecognized because of problems with "signal-to-noise ratio" and "zero adjustment" or "drift". Experience with the technique will indicate the kind of statistics which need to be incorporated in the development of a more sophisticated pattern recognition program.

METHOD

The technique derived in this report is to compare the size and shape correspondences between an unknown eddy current flaw pattern with a standard set of known patterns for the particular specimen geometry and eddy current test coil configuration. Two correlation coefficients are derived for each unknown with respect to one of the standard patterns. These correlation coefficients refer to the shape of the pattern correspondence (C_{ij}) and the magnitude correspondence (M_{ij}). Also given is the product correspondence of these two correlation factors.

$$P_{ij} = M_{ij} C_{ij}.$$

The result of the computer program is to derive a P_{ij} , M_{ij} and C_{ij} for each unknown pattern.

Analytical Development

Twenty-three patterns were provided as a basis for detection. The patterns were supplied on polar graph paper with the pole and polar axis being specified by the operator. Each pattern was represented mathematically by a set of measured values of pattern radius in inches and

polar angle in degrees. The polar angle was taken every 10° from the polar axis inclusive. At angles where the pattern was double valued, the largest radius was taken. Let the given pattern sets be defined

$$\vec{R}_i = \left\{ r_1(0^\circ), r_2(10^\circ), r_3(20^\circ), \dots, r_{36}(350^\circ) \right\}_i, \quad (1)$$

$$i = 1, 2, 3, \dots, 23.$$

where the r_k are the product of k th measured radius and the sensitivity in volts per inch at which that pattern was recorded.

Nine of the patterns were selected at random and values of $\vec{R}_i$ measured again with intentional error in the measured values of radii. These pattern sets were similarly defined

$$\vec{R}_j = \left\{ r_1(0^\circ), r_2(10^\circ), r_3(20^\circ), \dots, r_{36}(350^\circ) \right\}_j \quad (2)$$

$$j = 1, 2, 3, \dots, 9.$$

Hereafter r_{ij} is the i th measured radius of the j th pattern vector.

Correspondence in shape between the patterns in (1) and the patterns in (2) were obtained by evaluating the correlation coefficients (C_{ij}).

$$C_{ij} = \left(\sum_{k=1}^{36} r_{ik} r_{jk} \right) / \left(|\vec{R}_i| |\vec{R}_j| \right), \quad i = 1, 2, \dots, 23, \quad j = 1, 2, \dots, 9. \quad (3)$$

where

$$|\vec{R}_\ell| = \sqrt{\sum_k r_{\ell k}^2}, \quad \ell = i, j.$$

It can be shown that $0 \leq C_{ij} \leq 1$ for all i, j .

Correspondences in magnitude between the patterns in (1) and the patterns in (2) were obtained by evaluating the magnitude coefficients (M_{ij}).

$$M_{ij} = 1 - \left| 1 - |\vec{R}_j| / |\vec{R}_i| \right|, \quad i = 1, 2, \dots, 23, \quad j = 1, 2, \dots, 9. \quad (4)$$

It can be shown that $M_{ij} \leq 1$.

Values of C_{ij} near unity indicate the patterns have the same shape. Values of M_{ij} near unity indicate the patterns have the same size. Let the product P_{ij} be called the "correspondence" of pattern i with pattern j and be given by

$$P_{ij} = M_{ij} C_{ij}. \quad (5)$$

Then values of P_{ij} near unity indicate the pattern i has the same size and shape as the pattern j , and are termed corresponding patterns. Computer program results are listed in Appendix I in the form of tables in which these correspondences are demonstrated. The unknown patterns $j = 1, 2, 3, \dots, 9$ were designated AA through II. Data pertaining to unknown patterns are listed under the "unknown" column. The next three columns list corresponding pattern data, the first column having highest correspondence, the second lesser correspondence, etc. The known patterns are numbered in the row "variable number." The kind of flaw producing the pattern is given in the row "variable name." The C_{ij} are given in the row "correlation." The M_{ij} are given in the row " $1 - \text{ABS}(1 - \text{RX}/\text{RK})$." The P_{ij} are given in the row "product." The $|\vec{R}_\ell|$ are given in the row "magnitude." The next row of the table lists the sensitivity in volts/inch at which each pattern was recorded. The following rows contain the measured values in inches of pattern radii. The first column lists the angle in degrees at which the pattern radii were measured.

Tests on pattern recognition were made more severe by obtaining new recordings of arbitrary patterns. Some patterns were repetitions of the original 23 patterns. All patterns were recorded on rectangular

coordinate paper with no identification of the pole or polar axis except for the orientation. From a random selection of 20 patterns, 12 were identified as belonging to the 23 original patterns used as standards. Of these 12 patterns, 11 were identified in the first column after the unknown column and one in the second column. These results are listed under Appendix II with the unknown patterns, labeled A through T. You will note that some of the corresponding patterns were recorded at different sensitivities. This may account for reduced values of correlation coefficient since the different sized patterns were converted visually to digital data. The original 23 patterns are shown in Figures 1 through 23 of Appendix III. The 20 arbitrary patterns are shown in Figures 1 through 20 of Appendix IV. The computer program is given in Appendix V.

These results indicate feasibility of the mathematical technique for identifying arbitrary patterns. This technique then becomes the basis of a proposal for the development of an automatic test system for use in the field which will bring about improved flaw identification using eddy current techniques.

VARIABLE NUMBER	UNKNOWN	M(1) 9	M(2) 7	M(3) 8	M(4) 2	M(5) 4
VARIABLE NAME	AA	40% ID 1/16	20% ID 3/16	20% ID 1/8	40% ID 1/16	20% ID 3/16
CORRELATION	.0000	.9983	.7320	.7865	.7109	.3752
1-ABS(1-RX/RK)	.0000	.9859	.6417	.5433	.4421	.6266
PRODUCT	.0000	.9843	.4697	.4273	.3143	.2351
MAGNITUDE	10.3829	10.5310	16.1793	19.1114	23.4840	7.5600
SENSITIVITY V/IN	.5000	.5000	.5000	.5000	1.0000	.2000
DATA VECTOR - DEG	0	.0000	.1000	.5000	.0000	.0000
	10	.0000	.1000	.2000	.0000	.0000
	20	.0000	.1000	2.6000	.8000	.1000
	30	.0000	.1000	3.1000	.9000	.0000
	40	.0000	.2000	4.1000	1.2000	.0000
	50	.1000	.2000	6.0000	4.5000	.0000
	60	.3000	.2000	9.4000	11.0000	.0000
	70	9.9000	10.0000	19.4000	22.0000	.0000
	80	9.5000	10.0000	.2000	.0000	.0000
	90	4.0000	4.0000	.2000	.0000	10.0000
	100	3.0000	3.0000	.2000	1.5000	.0000
	110	2.5000	2.5000	.3000	1.8000	9.4000
	120	2.0000	2.1000	.3000	1.8000	.0000
	130	1.8000	1.9000	.3000	1.8000	.0000
	140	1.8000	1.8000	.4000	1.8000	.0000
	150	1.7000	1.7000	.5000	1.9000	.0000
	160	1.6000	1.7000	.5000	2.0000	.0000
	170	1.7000	1.8000	.6000	2.1000	.0000
	180	1.9000	1.9000	.8000	2.4000	.0000
	190	2.0000	2.0000	.9000	2.8000	.1000
	200	2.1000	2.1000	1.1000	3.2000	.1000
	210	2.4000	2.4000	1.8000	3.8000	1.1000
	220	3.0000	3.0000	3.3000	5.5000	2.2000
	230	4.0000	4.0000	5.4000	7.9000	4.8000
	240	6.0000	6.0000	9.8000	12.3000	8.2000
	250	9.9000	10.0000	18.5000	22.8000	13.0000
	260	4.0000	3.5000	1.1000	.0000	1.3000
	270	.0000	.9000	1.1000	1.2000	.6000
	280	.0000	.1000	1.2000	.7000	.2000
	290	.0000	.1000	1.2000	.5000	.1000
	300	.0000	.1000	1.3000	.4000	.2000
	310	.0000	.1000	1.3000	.4000	.1000
	320	.0000	.1000	1.4000	.3000	.0000
	330	.0000	.1000	1.5000	.3000	.0000
	340	.0000	.1000	1.6000	.3000	.0000
	350	.0000	.1000	1.8000	.4000	.0000

APPENDIX I
IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	BB	100% 1/8	100% 3/16	80% ID 1/8	40% OD 3/16	80% ID 3/16
CORRELATION	.0000	.9993	.9164	.7968	.0733	.9125
1-ABS(1-RX/RK)	.0000	.9998	.5493	-1.2848	-14.0064	-1.2151
PRODUCT	.0000	.9990	.5034	-1.0238	-1.0262	-1.1087
MAGNITUDE	291.7019	291.6316	531.0273	88.8041	18.2241	90.7290
SENSITIVITY V/IN	10.0000	10.0000	10.0000	2.0000	.2000	2.0000
DATA VECTOR - DEG	0	2.4000	3.7000	.0000	.8000	2.0000
	10	3.4000	5.2000	2.0000	.9000	3.2000
	20	4.9000	7.9000	4.0000	1.1000	5.1000
	30	6.9000	11.8000	6.9000	1.3000	8.9000
	40	9.7000	17.0000	11.0000	2.2000	14.9000
	50	13.3000	24.1000	18.4000	4.2000	27.0000
	60	.0000	20.4000	20.5000	7.9000	.0000
	70	.2000	1.9000	.0000	10.0000	.0000
	80	.5000	.8000	.0000	11.9000	.0000
	90	.6000	.6000	.0000	13.8000	.0000
	100	.0000	.1000	.0000	15.7000	.0000
	110	.0000	.1000	.0000	18.8000	.0000
	120	.0000	.1000	.0000	22.2000	.0000
	130	.0000	.7000	.0000	26.9000	.0000
	140	.2000	.9000	.0000	32.6000	.0000
	150	.3000	1.1000	.0000	40.8000	.0000
	160	.3000	1.6000	.5000	19.5000	.5000
	170	1.1000	2.2000	1.0000	.0000	1.0000
	180	1.9000	3.2000	1.9000	.0000	1.8000
	190	3.0000	4.9000	4.0000	.0000	3.7000
	200	4.4000	7.0000	6.8000	.0000	5.3000
	210	6.5000	10.4000	10.1000	.0000	8.6000
	220	9.9000	15.9000	17.4000	.0000	14.1000
	230	13.7000	24.5000	23.5000	.0000	25.8000
	240	11.0000	15.0000	.0000	.0000	1.0000
	250	1.6000	.0000	.0000	.0000	.0000
	260	.9000	.0000	.0000	.0000	.0000
	270	.6000	.0000	.0000	.0000	.0000
	280	.2000	.0000	.0000	.0000	.0000
	290	.2000	.0000	.0000	.0000	.0000
	300	.1000	.0000	.0000	8.8000	.0000
	310	.1000	.1000	.0000	14.2000	.0000
	320	.1000	.0000	.0000	19.9000	.0000
	330	.5000	1.0000	.0000	27.3000	.3000
	340	1.0000	1.3000	.0000	37.9000	.7000
	350	1.7000	2.2000	.0000	.9000	1.1000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	CC	6	18	5	10	4
		20% OD 1/16	50% OD .02DR	20% OD 1/8	40% OD 1/16	20% OD 3/16
CORRELATION	.0000	1.0000	.7696	.7903	.4266	.3612
1-ABS(1-RX/RK)	.0000	.9997	.7234	.5576	.7367	.7196
PRODUCT	.0000	.9996	.5568	.4407	.3143	.2599
MAGNITUDE	5.4399	5.4415	7.5194	3.7714	7.3838	7.5600
SENSITIVITY V/IN	.2000	.2000	.2000	.2000	.2000	.2000
DATA VECTOR - DEG	0	7.0000	8.8000	3.8000	2.5000	.0000
	10	7.0000	9.0000	3.2000	2.3000	.0000
	20	6.8000	9.0000	3.0000	2.1000	.0000
	30	6.2000	8.4000	2.9000	2.0000	.0000
	40	6.1000	7.4000	2.8000	.0000	.0000
	50	6.5000	6.8000	2.9000	.0000	.0000
	60	7.1000	6.3000	3.0000	.0000	.0000
	70	8.6000	6.0000	3.2000	.0000	.0000
	80	6.0000	5.9000	3.9000	.0000	.0000
	90	5.2000	5.3000	2.9000	.0000	10.0000
	100	5.2000	5.3000	3.0000	.0000	9.4000
	110	5.5000	5.5000	3.0000	.0000	9.6000
	120	5.9000	5.9000	3.2000	5.0000	10.0000
	130	6.5000	6.5000	3.6000	7.5000	10.8000
	140	7.5000	7.4000	4.2000	9.9000	11.8000
	150	7.8000	7.8000	5.1000	12.4000	.0000
	160	5.9000	5.9000	6.9000	15.1000	.0000
	170	.0000	.0000	.1000	15.8000	.0000
	180	.0000	.0000	.1000	.0000	.0000
	190	.0000	.0000	.1000	.0000	.0000
	200	.0000	.0000	.1000	.0000	.0000
	210	.0000	.0000	.0000	.0000	.0000
	220	.0000	.0000	.2000	.0000	.0000
	230	.0000	.0000	.3000	.0000	.0000
	240	.0000	.0000	.5000	.0000	.0000
	250	.0000	.0000	.9000	.0000	9.9000
	260	.0000	.0000	1.0000	.0000	10.9000
	270	.0000	2.5000	.0000	.0000	7.2000
	280	.0000	7.8000	.0000	.0000	8.7000
	290	.0000	8.1000	.0000	.0000	10.0000
	300	.0000	8.3000	.0000	.0000	11.2000
	310	.0000	8.1000	.0000	.0000	12.9000
	320	.0000	8.1000	.0000	.0000	7.5000
	330	.0000	8.1000	.0000	9.4000	.0000
	340	.0000	8.5000	10.0000	14.9000	.0000
	350	2.0000	2.0000	4.5000	14.9000	.0000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	DD	1	3	21	2	22
1-ABS(1-RX/RK)		40% ID 1/8	40% ID 3/16	80% ID 1/16	40% ID 1/16	100 OD .040P
CORRELATION	.0000	.9798	.9195	.8602	.8354	.5817
PRODUCT	.0000	.9424	.8933	.8396	.6441	.5182
MAGNITUDE	31.8423	.9234	.8214	.7222	.5381	.3014
SENSITIVITY V/IN	1.0000	33.7868	35.6448	37.9257	23.4840	61.4429
DATA VECTOR - DEG	0	1.0000	1.0000	2.0000	1.0000	1.0000
	10	.0000	1.1000	.0000	.0000	5.0000
	20	.5000	2.0000	.0000	.0000	7.9000
	30	2.2000	2.3000	.0000	.1000	11.3000
	40	4.0000	4.0000	.0000	1.2000	16.4000
	50	6.6000	6.5000	.0000	2.9000	22.2000
	60	10.5000	10.6000	3.8000	5.0000	28.0000
	70	13.9000	19.0000	6.2000	8.5000	1.1000
	80	7.0000	2.5000	.0000	13.3000	1.2000
	90	.6000	.7000	1.0000	.0000	1.3000
	100	.6000	.6000	.1000	.0000	1.6000
	110	.6000	.5000	.1000	.0000	1.9000
	120	.6000	.5000	.1000	.0000	2.0000
	130	.6000	.7000	.1000	.0000	2.1000
	140	.7000	.7000	.1000	.0000	2.6000
	150	.8000	.8000	.1000	.0000	3.0000
	160	.8000	.9000	.1000	.0000	3.8000
	170	.9000	.9000	.1000	.0000	4.3000
	180	1.0000	1.0000	.1000	.0000	5.5000
	190	1.2000	1.2000	.2000	.0000	7.2000
	200	1.6000	1.7000	1.0000	.1000	9.7000
	210	2.6000	2.8000	1.7000	.1000	12.4000
	220	4.2000	4.3000	3.0000	1.1000	17.1000
	230	6.2000	6.4000	5.0000	2.2000	23.0000
	240	10.2000	10.3000	7.7000	4.8000	28.1000
	250	18.4000	18.0000	10.6000	8.2000	.0000
	260	9.0000	9.5000	.0000	13.0000	.0000
	270	1.0000	.9000	.0000	1.3000	.0000
	280	.0000	.2000	.0000	.6000	.0000
	290	.0000	.0000	.0000	.2000	.0000
	300	.0000	.0000	.0000	.1000	.0000
	310	.0000	.0000	.0000	.2000	.0000
	320	.0000	.0000	.0000	.1000	.0000
	330	.0000	.0000	.0000	.0000	.0000
	340	.0000	.0000	.0000	.0000	.0000
	350	.0000	.0000	.0000	.0000	2.4000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	EF	18	4	10	6	16
CORRELATION	.0000	50% OD .02DR	20% OD 3/16	40% OD 1/16	20% OD 1/16	80 OD .02DR
1-ABS(1-RX/RK)	.0000	.9995	.5835	.4893	.7693	.6030
PRODUCT	.0000	.9955	.9902	.9862	.6243	.7050
MAGNITUDE	7.4857	.9950	.5777	.4826	.4803	.4251
SENSITIVITY V/IN	.2000	7.5194	7.5600	7.3838	5.4415	10.6184
DATA VECTOR - DEG	0	.2000	.2000	.2000	.2000	.2000
10	8.8000	8.8000	.0000	2.5000	7.0000	17.6000
20	9.0000	9.0000	.0000	2.3000	7.0000	21.1000
30	9.0000	9.0000	.0000	2.1000	6.7000	1.0000
40	8.5000	8.4000	.0000	2.0000	6.3000	.4000
50	7.5000	7.4000	.0000	.0000	6.2000	.0000
60	6.8000	6.8000	.0000	.0000	6.4000	.0000
70	6.5000	6.3000	.0000	.0000	7.1000	.0000
80	6.0000	6.0000	.0000	.0000	8.6000	.0000
90	5.9000	5.9000	.0000	.0000	6.0000	.0000
100	5.9000	5.9000	10.0000	.0000	5.3000	.0000
110	5.9000	6.0000	9.4000	.0000	5.3000	.9000
120	6.1000	6.1000	9.6000	.0000	5.5000	3.5000
130	6.7000	6.6000	10.0000	5.0000	5.9000	5.9000
140	6.0000	7.0000	10.8000	7.5000	6.5000	7.8000
150	8.0000	8.0000	11.8000	9.9000	7.4000	9.3000
160	9.1000	9.1000	.0000	12.4000	7.8000	11.2000
170	.0000	.0000	.0000	15.1000	5.9000	13.0000
180	.0000	.0000	.0000	15.8000	.0000	14.9000
190	.0000	.0000	.0000	.0000	.0000	17.1000
200	.0000	.0000	.0000	.0000	.0000	19.2000
210	.0000	.0000	.0000	.0000	.0000	1.8000
220	.0000	.0000	.0000	.0000	.0000	.6000
230	.0000	.0000	.0000	.0000	.0000	.0000
240	.0000	.0000	.0000	.0000	.0000	.0000
250	.0000	.0000	.0000	.0000	.0000	.0000
260	.0000	.0000	9.9000	.0000	.0000	.0000
270	.0000	.0000	10.9000	.0000	.0000	.0000
280	3.0000	2.5000	7.2000	.0000	.0000	.0000
290	7.8000	7.8000	8.7000	.0000	.0000	.0000
300	8.1000	8.1000	10.0000	.0000	.0000	7.0000
310	8.2000	8.3000	11.2000	.0000	.0000	7.2000
320	8.0000	8.1000	12.9000	.0000	.0000	7.9000
330	8.1000	8.1000	7.5000	.0000	.0000	6.8000
340	8.0000	8.1000	.0000	.0000	.0000	10.0000
350	8.4000	8.5000	.0000	9.4000	.0000	12.0000
	8.5000	8.6000	.0000	14.9000	2.0000	14.2000

APPENDIX I
IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

VARIABLE NUMBER	UNKNOWN	M(1) 23	M(2) 17	M(3) 16	M(4) 12	M(5) 13
VARIABLE NAME	FF	100 OD .02DR	50% OD .04DR	80 OD .02DR	40% ID 1/8	40% OD 3/16
CORRELATION	.0000	.9987	.3650	.5119	.2748	.2935
1-ABS(1-RX/RK)	.0000	.9983	.9478	.6697	.8904	.7751
PRODUCT	.0000	.9969	.3459	.3428	.2447	.2275
MAGNITUDE	14.1259	14.1506	14.9036	10.6184	15.8639	18.2241
SENSITIVITY V/IN	.5000	.5000	.5000	.2000	.2000	.2000
DATA VECTOR - DEG	0	4.5000	4.4000	17.3000	.9000	.8000
10	5.5000	5.6000	1.0000	21.1000	.9000	.9000
20	6.9000	6.9000	.2000	1.0000	.1000	1.1000
30	9.1000	9.2000	.0000	.4000	.1000	1.3000
40	11.6000	11.6000	.0000	.0000	.1000	2.2000
50	.0000	1.0000	.0000	.0000	.1000	4.2000
60	.0000	.0000	.0000	.0000	.2000	7.9000
70	.0000	.0000	.0000	.0000	.2000	10.0000
80	.0000	.0000	.0000	.0000	.2000	11.9000
90	2.0000	2.1000	.0000	.0000	.3000	13.8000
100	2.2000	2.2000	.0000	.9000	.3000	15.7000
110	2.2000	2.2000	.0000	3.5000	.6000	18.8000
120	2.2000	2.2000	.0000	5.9000	1.0000	22.2000
130	2.4000	2.3000	.0000	7.8000	2.0000	26.9000
140	2.6000	2.6000	.0000	9.3000	7.3000	32.6000
150	2.9000	2.9000	.0000	11.2000	14.9000	40.8000
160	3.4000	3.3000	7.0000	13.0000	24.1000	19.5000
170	4.1000	4.1000	10.8000	14.9000	34.1000	.0000
180	5.2000	5.1000	13.7000	17.1000	.0000	.0000
190	6.5000	6.4000	1.0000	19.2000	.0000	.0000
200	8.1000	8.2000	.0000	1.8000	.0000	.0000
210	10.1000	10.1000	.0000	.6000	.0000	.0000
220	12.3000	12.3000	.0000	.0000	.0000	.0000
230	.0000	.8000	.0000	.0000	.0000	.0000
240	.0000	.0000	.0000	.0000	.0000	.0000
250	.0000	.0000	.0000	.0000	.0000	.0000
260	.0000	.0000	.0000	.0000	.0000	.0000
270	.0000	.0000	.0000	.0000	6.5000	.0000
280	.0000	.0000	.0000	.0000	9.3000	.0000
290	.0000	.0000	.0000	7.0000	12.0000	.0000
300	.0000	.6000	.0000	7.2000	15.3000	8.8000
310	1.3000	1.2000	.0000	7.9000	19.4000	14.2000
320	1.7000	1.5000	5.0000	8.8000	24.0000	19.9000
330	2.0000	2.1000	7.2000	10.0000	29.1000	27.3000
340	2.8000	2.8000	9.9000	12.0000	33.7000	37.9000
350	3.2000	3.3000	12.4000	14.2000	28.7000	.9000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	GG	2	8	7	1	21
CORRELATION	.0000	40% ID 1/16	20% ID 1/8	20% ID 3/16	40% ID 1/8	80% ID 1/16
1-ABS(1-RX/RK)	.0000	.9980	.9591	.9745	.7626	.7483
PRODUCT	.0000	.9933	.7794	.5582	.6904	.6151
MAGNITUDE	.0000	.9914	.7475	.5439	.5265	.4602
SENSITIVITY V/IN	23.3275	23.4840	19.1114	16.1793	33.7868	37.9257
DATA VECTOR - DEG	0	1.0000	.5000	.5000	1.0000	2.0000
	10	.0000	.0000	2.0000	.0000	.0000
	20	.0000	.1000	2.6000	.0000	.0000
	30	1.5000	1.2000	3.1000	2.3000	.0000
	40	2.6000	2.9000	4.1000	4.0000	.0000
	50	5.2000	5.0000	6.0000	6.5000	.0000
	60	8.5000	8.5000	9.4000	10.6000	3.8000
	70	13.2000	11.0000	19.4000	19.0000	6.2000
	80	.0000	22.0000	.2000	2.5000	9.8000
	90	.0000	.0000	.2000	.7000	1.0000
	100	.0000	.0000	.2000	.6000	.1000
	110	.0000	1.5000	.3000	.5000	.1000
	120	.0000	1.8000	.3000	.5000	.1000
	130	.0000	1.8000	.3000	.7000	.1000
	140	.0000	1.8000	.4000	.8000	.1000
	150	.0000	1.9000	.5000	.9000	.1000
	160	.0000	2.0000	.5000	.9000	.1000
	170	.0000	2.1000	.6000	1.0000	.1000
	180	.0000	2.4000	.8000	1.2000	.2000
	190	.0000	2.8000	.9000	1.7000	1.0000
	200	.0000	3.2000	1.1000	2.8000	1.7000
	210	.0000	3.8000	1.8000	4.3000	3.0000
	220	2.1000	5.5000	3.3000	6.4000	5.0000
	230	4.4000	7.9000	5.4000	10.3000	7.7000
	240	8.0000	12.3000	9.8000	18.0000	10.6000
	250	13.1000	22.8000	18.5000	9.5000	.0000
	260	1.5000	.0000	1.1000	.9000	.0000
	270	.0000	1.2000	1.1000	.2000	.0000
	280	.0000	.2000	1.2000	.0000	.0000
	290	.0000	.5000	1.2000	.0000	.0000
	300	.0000	.4000	1.3000	.0000	.0000
	310	.0000	.4000	1.3000	.0000	.0000
	320	.0000	.3000	1.4000	.0000	.0000
	330	.0000	.3000	1.5000	.0000	.0000
	340	.0000	.3000	1.6000	.0000	.0000
	350	.0000	.4000	1.8000	.0000	.0000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1) 21	M(2) 3	M(3) 1	M(4) 2	M(5) 22
VARIABLE NAME	HH	80% ID 1/16	40% ID 3/16	40% ID 1/8	40% ID 1/16	100 OD .04DR
CORRELATION	.0000	.9879	.8554	.8474	.7446	.5146
1-ABS(1-RX/RK)	.0000	.9407	.9991	.9441	.4809	.5806
PRODUCT	.0000	.9293	.8546	.8000	.3580	.2988
MAGNITUDE	35.6758	37.9257	35.6448	33.7868	23.4340	61.4429
SENSITIVITY V/IN	2.0000	2.0000	1.0000	1.0000	1.0000	1.0000
DATA VECTOR - DEG	0	.0000	1.1000	.0000	.0000	5.0000
	10	.0000	.0000	.0000	.0000	7.9000
	20	.0000	.0000	2.3000	.1000	11.3000
	30	.0000	.0000	4.0000	1.2000	16.4000
	40	1.5000	.0000	6.5000	2.9000	22.2000
	50	3.9000	3.8000	11.2000	5.0000	28.0000
	60	6.4000	6.2000	19.0000	8.5000	1.1000
	70	7.2000	9.8000	2.5000	13.3000	1.2000
	80	1.0000	1.0000	.7000	.0000	1.3000
	90	.0000	.1000	.6000	.0000	1.6000
	100	.0000	.1000	.5000	.0000	1.9000
	110	.0000	.1000	.5000	.0000	2.0000
	120	.0000	.1000	.7000	.0000	2.1000
	130	.0000	.1000	.7000	.0000	2.6000
	140	.0000	.1000	.8000	.0000	3.0000
	150	.0000	.1000	.9000	.0000	3.8000
	160	.0000	.1000	.9000	.0000	4.3000
	170	.0000	.1000	1.0000	.0000	5.5000
	180	.0000	.2000	1.2000	.0000	7.2000
	190	.5000	1.0000	1.7000	.1000	9.7000
	200	1.6000	1.7000	2.8000	.1000	12.4000
	210	3.0000	3.0000	4.3000	1.1000	17.1000
	220	5.0000	5.0000	6.4000	2.2000	23.0000
	230	7.6000	7.7000	10.3000	4.8000	28.1000
	240	10.6000	10.6000	18.0000	8.2000	.0000
	250	.0000	.0000	9.5000	13.0000	.0000
	260	.0000	.0000	.9000	1.3000	.0000
	270	.0000	.0000	.2000	.6000	.0000
	280	.0000	.0000	.0000	.2000	.0000
	290	.0000	.0000	.0000	.1000	.0000
	300	.0000	.0000	.0000	.2000	.0000
	310	.0000	.0000	.0000	.1000	.0000
	320	.0000	.0000	.0000	.0000	.0000
	330	.0000	.0000	.0000	.0000	.0000
	340	.0000	.0000	.0000	.0000	.0000
	350	.0000	.0000	.0000	.0000	2.4000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1) 3	M(2) 1	M(3) 21	M(4) 22	M(5) 29
VARIABLE NAME	II	40% ID 3/16	40% ID 1/8	80% ID 1/16	100 GD .040R	80% ID 1/8
CORRELATION	.0000	.9999	.9500	.7859	.5463	.7531
1-ABS(1-RX/RK)	.0000	.9990	.9460	.9390	.5796	.4010
PRODUCT	.0000	.9989	.8987	.7379	.3166	.3020
MAGNITUDE	35.6107	35.6448	33.7868	37.9257	61.4429	88.8041
SENSITIVITY V/IN	1.0000	1.0000	1.0000	2.0000	1.0000	2.0000
DATA VECTOR - DEG	0	1.2000	1.1000	.0000	5.0000	.0000
	10	1.9000	2.0000	.0000	7.9000	2.0000
	20	3.0000	2.9000	2.3000	11.3000	4.0000
	30	4.2000	4.6000	4.0000	16.4000	6.9000
	40	6.9000	6.8000	6.5000	22.2000	11.0000
	50	11.3000	11.2000	10.6000	28.0000	18.4000
	60	20.6000	20.7000	19.0000	1.1000	20.5000
	70	.0000	.0000	2.5000	1.2000	.0000
	80	.0000	.0000	.7000	1.3000	.0000
	90	.0000	.0000	.6000	1.6000	.0000
	100	.0000	.0000	.5000	1.9000	.0000
	110	.0000	.0000	.5000	2.0000	.0000
	120	.0000	.0000	.7000	2.1000	.0000
	130	.0000	.0000	.7000	2.6000	.0000
	140	.0000	.0000	.8000	3.0000	.0000
	150	.0000	.0000	.9000	3.8000	.0000
	160	.0000	.0000	.9000	4.3000	.5000
	170	.0000	.0000	1.0000	5.5000	1.0000
	180	.0000	.0000	1.2000	7.2000	1.9000
	190	1.6000	1.5000	1.7000	9.7000	4.0000
	200	2.4000	2.5000	2.8000	12.4000	6.8000
	210	4.0000	4.0000	4.3000	17.1000	10.1000
	220	6.8000	6.7000	6.4000	23.0000	17.4000
	230	11.0000	11.0000	10.3000	28.1000	23.5000
	240	21.1000	21.1000	18.0000	.0000	.0000
	250	.0000	.0000	9.5000	.0000	.0000
	260	.0000	.0000	.9000	.0000	.0000
	270	.0000	.0000	.2000	.0000	.0000
	280	.0000	.0000	.0000	.0000	.0000
	290	.0000	.0000	.0000	.0000	.0000
	300	.0000	.0000	.0000	.0000	.0000
	310	.0000	.0000	.0000	.0000	.0000
	320	.0000	.0000	.0000	.0000	.0000
	330	.0000	.0000	.0000	.0000	.0000
	340	.0000	.0000	.0000	.0000	.0000
	350	.0000	.0000	.0000	2.4000	.0000

IDENTIFICATION OF CORRESPONDING STANDARD PATTERNS
WHERE THE UNKNOWN PATTERNS CONTAIN READING NOISE

APPENDIX I

VARIABLE NUMBER	UNKNOWN	M(1) 2	M(2) 8	M(3) 1	M(4) 7	M(5) 21
VARIABLE NAME	A	40% ID 1/16	20% ID 1/8	40% ID 1/8	20% ID 3/16	80% ID 1/16
CORRELATION	.0000	.9852	.9607	.7851	.9706	.7802
1-ABS(1-RX/RK)	.0000	.9979	.7738	.6936	.5515	.6179
PRODUCT	.0000	.9831	.7434	.5445	.5353	.4856
MAGNITUDE	23.4350	23.4840	19.1114	33.7868	16.1793	37.9257
SENSITIVITY V/IN	2.0000	1.0000	.5000	1.0000	.5000	2.0000
DATA VECTOR - DEG	0	.0000	.5000	.0000	2.0000	.0000
	10	.2000	.0000	.0000	2.2000	.0000
	20	.5000	.1000	.8000	2.6000	.0000
	30	.8000	1.2000	.9000	3.1000	.0000
	40	1.5000	2.9000	1.2000	4.1000	.0000
	50	2.5000	5.0000	4.5000	6.0000	3.8000
	60	4.0000	8.5000	11.0000	9.4000	6.2000
	70	6.5000	13.3000	22.0000	19.4000	9.8000
	80	1.5000	.0000	.0000	.2000	1.0000
	90	.5000	.0000	.0000	.2000	.1000
	100	.2000	.0000	1.5000	.2000	.1000
	110	.0000	.0000	1.8000	.3000	.1000
	120	.0000	.0000	1.8000	.3000	.1000
	130	.0000	.0000	1.8000	.3000	.1000
	140	.0000	.0000	1.8000	.4000	.1000
	150	.0000	.0000	1.9000	.5000	.1000
	160	.0000	.0000	2.0000	.5000	.1000
	170	.0000	.0000	2.1000	.6000	.1000
	180	.0000	.0000	2.4000	.8000	.2000
	190	.0000	.1000	2.8000	.9000	1.0000
	200	.5000	.1000	3.2000	1.1000	1.7000
	210	1.0000	1.1000	3.8000	1.8000	3.0000
	220	1.5000	2.2000	5.5000	3.3000	5.0000
	230	2.5000	4.8000	7.9000	5.4000	7.7000
	240	4.2000	8.2000	12.3000	9.8000	10.6000
	250	6.3000	13.0000	22.8000	18.5000	.0000
	260	.0000	1.3000	.0000	1.1000	.0000
	270	.0000	.6000	1.2000	1.1000	.0000
	280	.0000	.2000	.7000	1.2000	.0000
	290	.0000	.1000	.5000	1.2000	.0000
	300	.0000	.2000	.4000	1.3000	.0000
	310	.0000	.1000	.4000	1.3000	.0000
	320	.0000	.0000	.3000	1.4000	.0000
	330	.0000	.0000	.3000	1.5000	.0000
	340	.0000	.0000	.3000	1.6000	.0000
	350	.0000	.0000	.4000	1.8000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	B	3	1	21	22	20
CORRELATION	.0000	40% ID 3/16	40% ID 1/8	80% ID 1/16	100 OD .04DR	80% ID 1/8
1-ABS(1-RX/RK)	.0000	.8993	.9605	.6780	.5106	.6792
PRODUCT	.0000	.8961	.8354	.9625	.6404	.4431
MAGNITUDE	39.3477	.8058	.8024	.6526	.3270	.3009
SENSITIVITY V/IN	2.0000	35.6448	33.7868	37.9257	61.4429	88.8041
DATA VECTOR - DEG	0	1.0000	1.0000	2.0000	1.0000	2.0000
	10	1.6000	.0000	.0000	5.0000	.0000
	20	1.9000	.0000	.0000	7.9000	2.0000
	30	2.3000	2.3000	.0000	11.3000	4.0000
	40	2.8000	4.6000	.0000	16.4000	6.9000
	50	4.2000	6.8000	.0000	22.2000	11.0000
	60	6.2000	11.2000	3.8000	28.0000	18.4000
	70	10.3000	20.7000	6.2000	1.1000	20.5000
	80	.0000	.0000	9.8000	1.2000	.0000
	90	.0000	.7000	1.0000	1.3000	.0000
	100	.0000	.6000	.1000	1.6000	.0000
	110	.0000	.5000	.1000	1.9000	.0000
	120	.0000	.5000	.1000	2.0000	.0000
	130	.0000	.7000	.1000	2.1000	.0000
	140	.0000	.7000	.1000	2.6000	.0000
	150	.0000	.8000	.1000	3.0000	.0000
	160	.0000	.9000	.1000	3.8000	.0000
	170	.0000	.9000	.1000	4.3000	.5000
	180	.0000	1.0000	.1000	5.5000	1.0000
	190	.0000	1.2000	.2000	7.2000	1.9000
	200	.0000	1.5000	1.0000	9.7000	4.0000
	210	.0000	1.7000	1.7000	12.4000	6.8000
	220	1.5000	2.5000	3.0000	17.1000	10.1000
	230	3.0000	4.0000	5.0000	23.0000	17.4000
	240	5.2000	6.7000	7.7000	28.1000	23.5000
	250	10.0000	11.0000	10.6000	.0000	.0000
	260	21.0000	18.0000	.0000	.0000	.0000
	270	7.7000	9.5000	.0000	.0000	.0000
	280	.9000	.9000	.0000	.0000	.0000
	290	.5000	.2000	.0000	.0000	.0000
	300	.5000	.0000	.0000	.0000	.0000
	310	.6000	.0000	.0000	.0000	.0000
	320	.7000	.0000	.0000	.0000	.0000
	330	.8000	.0000	.0000	.0000	.0000
	340	.9000	.0000	.0000	.0000	.0000
	350	1.0000	.0000	.0000	.0000	.0000
		1.2000	.0000	.0000	.0000	.0000
		1.4000	.0000	.0000	2.4000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	C	3	1	21	22	20
CORRELATION	.0000	40% ID 3/16	40% ID 1/8	80% ID 1/16	100% ID .0418	80% ID 1/8
1-ABS(1-RX/RK)	.0000	.0950	.9519	.7969	.5514	.7495
PRODUCT	.0000	.8870	.8258	.9540	.6457	.6467
MAGNITUDE	.0000	.8826	.7861	.7602	.3560	.3348
SENSITIVITY V/IN	39.6717	35.6448	33.7868	37.9257	61.4429	88.8041
DATA VECTOR - DEG	2.0000	1.0000	1.0000	2.0000	1.0000	2.0000
0	.0000	1.1000	.0000	.0000	5.0000	.0000
10	1.0000	2.0000	.0000	.0000	7.9000	2.0000
20	1.5000	2.9000	2.3000	.0000	11.3000	4.0000
30	2.0000	4.6000	4.0000	.0000	16.4000	6.9000
40	3.5000	6.8000	6.5000	.0000	22.2000	11.0000
50	5.8000	11.2000	10.6000	3.8000	28.0000	18.4000
60	11.3000	20.7000	19.0000	6.2000	1.1000	20.5000
70	.0000	.0000	2.5000	9.8000	1.2000	.0000
80	.0000	.0000	.7000	1.0000	1.3000	.0000
90	.0000	.0000	.6000	.1000	1.6000	.0000
100	.0000	.0000	.5000	.1000	1.9000	.0000
110	.1000	.0000	.5000	.1000	2.0000	.0000
120	.2000	.0000	.7000	.1000	2.1000	.0000
130	.3000	.0000	.7000	.1000	2.6000	.0000
140	.4000	.0000	.8000	.1000	3.0000	.0000
150	.5000	.0000	.9000	.1000	3.8000	.0000
160	.6000	.0000	.9000	.1000	4.3000	.5000
170	.7000	.0000	1.0000	.1000	5.5000	1.0000
180	1.0000	.0000	1.2000	.2000	7.2000	1.9000
190	1.3000	1.5000	1.7000	1.0000	9.7000	4.0000
200	1.7000	2.5000	2.8000	1.7000	12.4000	6.8000
210	2.5000	4.0000	4.3000	3.0000	17.1000	10.1000
220	3.8000	6.7000	6.4000	5.0000	23.0000	17.4000
230	6.4000	11.0000	10.3000	7.7000	28.1000	23.5000
240	12.0000	21.1000	18.0000	10.8000	.0000	.0000
250	.0000	.0000	9.5000	.0000	.0000	.0000
260	.0000	.0000	.9000	.0000	.0000	.0000
270	.0000	.0000	.2000	.0000	.0000	.0000
280	.0000	.0000	.0000	.0000	.0000	.0000
290	.0000	.0000	.0000	.0000	.0000	.0000
300	.0000	.0000	.0000	.0000	.0000	.0000
310	.0000	.0000	.0000	.0000	.0000	.0000
320	.0000	.0000	.0000	.0000	.0000	.0000
330	.0000	.0000	.0000	.0000	.0000	.0000
340	.0000	.0000	.0000	.0000	.0000	.0000
350	.0000	.0000	.0000	.0000	2.4000	.0000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	D	9	7	8	2	4
CORRELATION	.0000	40% ID 1/16	20% ID 3/16	20% ID 1/8	40% ID 1/16	20% ID 3/16
1-ABS(1-RX/RK)	.0000	.9070	.8793	.9267	.8794	.2797
PRODUCT	.0000	.9065	.5900	.4995	.4065	.7373
MAGNITUDE	.0000	.8222	.5188	.4629	.3575	.2062
SENSITIVITY V/IN	9.5462	10.5310	16.1793	19.1114	23.4840	7.5600
DATA VECTOR - DEG	1.0000	.5000	.5000	.5000	1.0000	.2000
0	.0000	.1000	2.0000	.5000	.0000	.0000
10	.0000	.1000	2.2000	.6000	.0000	.0000
20	.0000	.1000	2.6000	.8000	.1000	.0000
30	.0000	.1000	3.1000	.9000	1.2000	.0000
40	.0000	.2000	4.1000	1.2000	2.9000	.0000
50	.0000	.2000	6.0000	4.5000	5.0000	.0000
60	2.8000	.2000	9.4000	11.0000	8.5000	.0000
70	4.5000	10.0000	19.4000	22.0000	13.3000	.0000
80	3.0000	10.0000	.2000	.0000	.0000	.0000
90	1.0000	4.0000	.2000	.0000	.0000	10.0000
100	.8000	3.0000	.2000	1.5000	.0000	9.4000
110	.7000	2.5000	.3000	1.8000	.0000	9.6000
120	.6000	2.1000	.3000	1.8000	.0000	10.0000
130	.5000	1.9000	.3000	1.8000	.0000	10.8000
140	.5000	1.8000	.4000	1.8000	.0000	11.8000
150	.5000	1.7000	.5000	1.9000	.0000	.0000
160	.5000	1.7000	.5000	2.0000	.0000	.0000
170	.5000	1.8000	.6000	2.1000	.0000	.0000
180	.5000	1.9000	.8000	2.4000	.0000	.0000
190	.6000	2.0000	.9000	2.8000	.1000	.0000
200	.7000	2.1000	1.1000	3.2000	.1000	.0000
210	.8000	2.4000	1.8000	3.8000	1.1000	.0000
220	1.0000	3.0000	3.3000	5.5000	2.2000	.0000
230	1.6000	4.0000	5.4000	7.9000	4.8000	.0000
240	3.0000	6.0000	9.8000	12.3000	8.2000	.0000
250	6.0000	10.0000	18.5000	22.8000	13.0000	9.9000
260	.0000	3.5000	1.1000	.0000	1.3000	10.9000
270	.0000	.9000	1.1000	1.2000	.6000	7.2000
280	.0000	.1000	1.2000	.7000	.2000	8.7000
290	.0000	.1000	1.2000	.5000	.1000	10.0000
300	.0000	.1000	1.3000	.4000	.2000	11.2000
310	.0000	.1000	1.3000	.4000	.1000	12.9000
320	.0000	.1000	1.4000	.3000	.0000	7.5000
330	.0000	.1000	1.5000	.3000	.0000	.0000
340	.0000	.1000	1.6000	.3000	.0000	.0000
350	.0000	.1000	1.8000	.4000	.0000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	(	20% ID 1/8	40% ID 1/16	20% ID 3/16	80% ID 1/16	40% ID 1/8
CORRELATION	.0000	.9825	.9381	.9473	.7441	.6628
1-ABS(1-RX/RK)	.0000	.8967	.8979	.6967	.5560	.6241
PRODUCT	.0000	.8810	.8423	.6680	.4137	.4136
MAGNITUDE	21.0858	19.1114	23.4840	16.1793	37.9257	33.7868
SENSITIVITY V/IN	1.0000	.5000	1.0000	.5000	2.0000	1.0000
DATA VECTOR - DEG	0	.5000	.0000	2.0000	.0000	.0000
	10	.5000	.6000	2.2000	.0000	.0000
	20	.5000	.8000	2.6000	.0000	2.3000
	30	.5000	.9000	3.1000	.0000	4.0000
	40	.6000	1.2000	4.1000	.0000	6.5000
	50	.8000	4.5000	5.0000	3.8000	10.6000
	60	6.5000	11.0000	8.5000	6.2000	17.0000
	70	13.7000	22.0000	13.3000	9.3000	27.5000
	80	.0000	.0000	.0000	1.0000	.7000
	90	1.8000	.0000	.2000	.1000	.5000
	100	1.7000	1.5000	.0000	.2000	.1000
	110	1.6000	1.8000	.0000	.3000	.1000
	120	1.5000	1.8000	.0000	.3000	.1000
	130	1.4000	1.8000	.0000	.3000	.1000
	140	1.3000	1.8000	.0000	.4000	.1000
	150	1.2000	1.9000	.0000	.5000	.1000
	160	1.3000	2.0000	.0000	.5000	.1000
	170	1.4000	2.1000	.0000	.6000	.1000
	180	1.5000	2.4000	.0000	.8000	.2000
	190	1.6000	2.8000	.1000	.9000	.3000
	200	1.8000	3.2000	.1000	1.1000	.4000
	210	2.0000	3.8000	1.1000	1.3000	.5000
	220	2.8000	5.5000	2.2000	3.3000	6.4000
	230	3.9000	7.9000	4.6000	5.4000	10.3000
	240	6.0000	12.3000	8.2000	9.3000	16.0000
	250	11.0000	22.0000	13.0000	16.5000	27.5000
	260	.8000	.0000	1.3000	.0000	.0000
	270	.0000	1.2000	.6000	1.1000	.2000
	280	.0000	.7000	.2000	1.2000	.0000
	290	.0000	.5000	.1000	1.2000	.0000
	300	.0000	.4000	.2000	1.3000	.0000
	310	.0000	.4000	.1000	1.3000	.0000
	320	.0000	.3000	.0000	1.4000	.0000
	330	.0000	.3000	.0000	1.5000	.0000
	340	.0000	.3000	.0000	1.6000	.0000
	350	.5000	.4000	.0000	1.8000	.0000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX 11

VARIABLE NUMBER	UNKNOWN	M(1) 7	M(2) 8	M(3) 9	M(4) 2	M(5) 21
VARIABLE NAME	F	20% ID 3/16	20% ID 1/8	40% ID 1/16	40% ID 1/16	80% ID 1/16
CORRELATION	.0000	.7392	.7835	.7225	.7501	.9280
1-ABS(1-RX/RK)	.0000	.8206	.6947	.7392	.5654	.3501
PRODUCT	.0000	.6066	.5443	.5341	.4241	.3249
MAGNITUDE	13.2774	16.1793	19.1114	10.5310	23.4840	37.9257
SENSITIVITY V/IN	1.0000	.5000	.5000	.5000	1.0000	2.0000
DATA VECTOR - DEG	0	.0000	.0000	.0000	.0000	.0000
	10	.0000	.0000	.0000	.0000	.0000
	20	.0000	.0000	.0000	.0000	.0000
	30	.0000	.0000	.0000	.0000	.0000
	40	.0000	.0000	.0000	.0000	.0000
	50	.0000	.0000	.0000	.0000	.0000
	60	.0000	.0000	.0000	.0000	.0000
	70	.0000	.0000	.0000	.0000	.0000
	80	.0000	.0000	.0000	.0000	.0000
	90	.0000	.0000	.0000	.0000	.0000
	100	.0000	.0000	.0000	.0000	.0000
	110	.0000	.0000	.0000	.0000	.0000
	120	.0000	.0000	.0000	.0000	.0000
	130	.0000	.0000	.0000	.0000	.0000
	140	.0000	.0000	.0000	.0000	.0000
	150	.0000	.0000	.0000	.0000	.0000
	160	.0000	.0000	.0000	.0000	.0000
	170	.0000	.0000	.0000	.0000	.0000
	180	.0000	.0000	.0000	.0000	.0000
	190	.0000	.0000	.0000	.0000	.0000
	200	.0000	.0000	.0000	.0000	.0000
	210	.0000	.0000	.0000	.0000	.0000
	220	.0000	.0000	.0000	.0000	.0000
	230	.0000	.0000	.0000	.0000	.0000
	240	.0000	.0000	.0000	.0000	.0000
	250	.0000	.0000	.0000	.0000	.0000
	260	.0000	.0000	.0000	.0000	.0000
	270	.0000	.0000	.0000	.0000	.0000
	280	.0000	.0000	.0000	.0000	.0000
	290	.0000	.0000	.0000	.0000	.0000
	300	.0000	.0000	.0000	.0000	.0000
	310	.0000	.0000	.0000	.0000	.0000
	320	.0000	.0000	.0000	.0000	.0000
	330	.0000	.0000	.0000	.0000	.0000
	340	.0000	.0000	.0000	.0000	.0000
	350	.0000	.0000	.0000	.0000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	G	100% 3/16	100% 1/8	20% 00 3/16	40% 00 3/16	40% 10 1/8
CORRELATION	.0000	.0780	.9710	.0172	.1093	.1010
1-ARS(1-RX/RK)	.0000	.9599	.2521	-65.4260	-25.9708	-30.1321
PRODUCT	.0000	.9388	.2448	-1.1229	-2.8389	-3.0662
MAGNITUDE	509.7421	531.0273	291.6316	7.5000	18.2241	15.8639
SENSITIVITY V/IN	10.0000	10.0000	10.0000	.2000	.2000	.2000
DATA VECTOR - DEG	0	4.3000	3.7000	.0000	.8000	.9000
	10	5.9000	5.2000	.0000	.9000	.9000
	20	8.3000	7.9000	.0000	1.1000	.1000
	30	12.0000	11.8000	.0000	1.3000	.1000
	40	17.8000	17.0000	.0000	2.2000	.1000
	50	24.6000	24.1000	.0000	4.2000	.1000
	60	10.0000	20.4000	.0000	7.9000	.2000
	70	.0000	1.9000	.0000	10.0000	.2000
	80	.0000	.8000	.0000	11.9000	.2000
	90	.0000	.6000	.0000	13.8000	.3000
	100	.0000	.1000	.0000	15.7000	.3000
	110	.0000	.1000	.0000	18.8000	.5000
	120	.0000	.1000	.0000	22.2000	1.0000
	130	.0000	.7000	.0000	26.9000	2.0000
	140	.5000	.9000	.0000	32.6000	7.3000
	150	.6000	1.1000	.0000	40.8000	14.9000
	160	1.2000	1.6000	.0000	19.5000	24.1000
	170	2.0000	2.2000	.0000	.0000	34.1000
	180	3.0000	3.2000	.0000	.0000	.0000
	190	4.5000	4.9000	.0000	.0000	.0000
	200	7.0000	7.0000	.0000	.0000	.0000
	210	10.5000	10.4000	.0000	.0000	.0000
	220	16.5000	15.9000	.0000	.0000	.0000
	230	25.0000	24.5000	.0000	.0000	.0000
	240	14.0000	15.0000	.0000	.0000	.0000
	250	.0000	.0000	.0000	.0000	.0000
	260	.0000	.0000	.0000	.0000	.0000
	270	.0000	.0000	.0000	.0000	6.5000
	280	.0000	.0000	.0000	.0000	9.3000
	290	.0000	.0000	.0000	.0000	12.0000
	300	.5000	.0000	.0000	8.8000	15.3000
	310	.8000	.0000	.0000	14.2000	19.4000
	320	1.5000	.0000	.0000	19.9000	24.0000
	330	1.8000	1.0000	.0000	27.3000	29.1000
	340	2.4000	1.3000	.0000	37.9000	33.7000
	350	3.2000	2.2000	.0000	.9000	28.7000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	H	15	11	4	19	20
CORRELATION	.0000	100% 1/8	100% 3/16	20% OD 3/16	80% ID 3/16	80% ID 1/8
1-ABS(1-RX/RK)	.0000	.9775	.9551	.0000	.9441	.8887
PRODUCT	.0000	.9504	.5220	-34.6630	-1.0550	-1.1212
MAGNITUDE	277.1732	.9291	.4985	-.0000	-.9960	-.9964
SENSITIVITY V/IN	10.0000	291.6316	531.0273	7.5600	90.7290	88.8041
DATA VECTOR - DEG	0	10.0000	10.0000	.2000	2.0000	2.0000
	10	2.2000	2.4000	.0000	2.0000	.0000
	20	3.2000	3.4000	.0000	3.2000	2.0000
	30	4.5000	4.9000	.0000	5.1000	4.0000
	40	6.7000	6.9000	.0000	8.9000	6.9000
	50	9.5000	9.8000	.0000	14.9000	11.0000
	60	12.8000	13.2000	.0000	27.0000	18.4000
	70	3.3000	.0000	20.4000	.0000	20.5000
	80	.0000	.0000	1.9000	.0000	.0000
	90	.0000	.0000	.8000	.0000	.0000
	100	.0000	.0000	.6000	.0000	.0000
	110	.0000	.0000	10.0000	.0000	.0000
	120	.0000	.0000	9.4000	.0000	.0000
	130	.0000	.0000	.1000	.0000	.0000
	140	.0000	.0000	.1000	.0000	.0000
	150	.0000	.0000	.1000	.0000	.0000
	160	.0000	.0000	.1000	.0000	.0000
	170	.0000	.0000	.1000	.0000	.0000
	180	.0000	.0000	.1000	.0000	.0000
	190	.0000	.0000	.1000	.0000	.0000
	200	.0000	.0000	.1000	.0000	.0000
	210	.0000	.0000	.1000	.0000	.0000
	220	.0000	.0000	.1000	.0000	.0000
	230	.0000	.0000	.1000	.0000	.0000
	240	.0000	.0000	.1000	.0000	.0000
	250	.0000	.0000	.1000	.0000	.0000
	260	.0000	.0000	.1000	.0000	.0000
	270	.0000	.0000	.1000	.0000	.0000
	280	.0000	.0000	.1000	.0000	.0000
	290	.0000	.0000	.1000	.0000	.0000
	300	.0000	.0000	.1000	.0000	.0000
	310	.0000	.0000	.1000	.0000	.0000
	320	.0000	.0000	.1000	.0000	.0000
	330	.0000	.0000	.1000	.0000	.0000
	340	.0000	.0000	.1000	.0000	.0000
	350	.0000	.0000	.1000	.0000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	I	20	19	14	22	15
CORRELATION	.0000	80% ID 1/8	80% ID 3/16	100% 1/16	100% ID .04ER	10% 1/8
1-APS(1-RX/RK)	.0000	.8554	.7697	.8847	.7176	.8652
PRODUCT	.0000	.9598	.9394	.9855	.6128	.2923
MAGNITUDE	.0000	.8210	.7231	.6748	.4397	.2529
SENSITIVITY V/IN	85.2351	88.8041	90.7290	86.4884	61.4429	291.6316
DATA VECTOR - DEG	1.0000	2.0000	2.0000	2.0000	1.0000	10.0000
0	.0000	.0000	2.0000	5.4000	5.0000	2.4000
10	.0000	2.0000	3.2000	7.2000	7.9000	3.4000
20	.0000	4.0000	5.1000	9.8000	11.3000	4.9000
30	12.0000	6.9000	8.9000	12.9000	16.4000	6.9000
40	21.8000	11.0000	14.9000	17.0000	22.2000	9.8000
50	37.3000	18.4000	27.0000	19.9000	28.0000	13.2000
60	34.6000	20.5000	.0000	.5000	1.1000	.0000
70	2.0000	.0000	.0000	.5000	1.2000	.0000
80	.0000	.0000	.0000	.6000	1.3000	.0000
90	.0000	.0000	.0000	.7000	1.6000	.0000
100	.0000	.0000	.0000	.8000	1.9000	.0000
110	.0000	.0000	.0000	.9000	2.0000	.0000
120	.0000	.0000	.0000	1.1000	2.1000	.0000
130	.0000	.0000	.0000	1.2000	2.6000	.0000
140	.0000	.0000	.0000	1.5000	3.0000	.0000
150	.0000	.0000	.0000	2.0000	3.8000	.0000
160	.0000	.5000	.5000	2.7000	4.3000	.0000
170	.0000	1.0000	1.0000	3.3000	5.5000	1.1000
180	1.0000	1.9000	1.8000	4.5000	7.2000	1.9000
190	3.5000	4.0000	3.7000	6.1000	9.7000	3.0000
200	8.0000	6.8000	5.3000	8.2000	12.4000	4.5000
210	13.5000	10.1000	8.6000	11.5000	17.1000	5.4000
220	23.7000	17.4000	14.1000	15.4000	23.0000	9.9000
230	38.3000	23.5000	25.8000	16.0000	28.1000	13.8000
240	42.0000	.0000	1.0000	.0000	.0000	11.0000
250	1.0000	.0000	.0000	.0000	.0000	1.6000
260	.5000	.0000	.0000	.0000	.0000	.6000
270	.0000	.0000	.0000	.0000	.0000	.4000
280	.0000	.0000	.0000	.0000	.0000	.2000
290	.0000	.0000	.0000	1.1000	.0000	.2000
300	.0000	.0000	.0000	1.3000	.0000	.2000
310	.0000	.0000	.0000	1.5000	.0000	.1000
320	.0000	.0000	.0000	1.9000	.0000	.1000
330	.0000	.0000	.3000	2.6000	.0000	.1000
340	.0000	.0000	.7000	3.2000	.0000	1.0000
350	.0000	.0000	1.1000	4.2000	2.4000	1.6000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	J	3	1	21	22	20
CORRELATION	.0000	40% ID 3/16	40% ID 1/8	80% ID 1/16	100 OD .04DR	80% ID 1/8
1-ABS(1-RX/RK)	.0000	.9884	.9454	.8045	.6524	.8186
PRODUCT	.0000	.8753	.8134	.9429	.6525	.4515
MAGNITUDE	40.0913	.8651	.7690	.7586	.4257	.3696
SENSITIVITY V/IN	1.0000	35.6448	33.7868	37.9257	61.4429	88.8041
DATA VECTOR - DEG	0	1.0000	1.0000	2.0000	1.0000	2.0000
10	1.2000	1.1000	.0000	.0000	5.0000	.0000
20	2.2000	2.0000	.0000	.0000	7.9000	2.0000
30	3.6000	2.9000	2.3000	.0000	11.3000	4.0000
40	5.7000	4.6000	4.0000	.0000	16.4000	6.9000
50	9.5000	6.8000	6.5000	.0000	22.2000	11.0000
60	14.3000	11.2000	10.6000	3.8000	28.0000	18.4000
70	20.2000	20.7000	19.0000	6.2000	1.1000	20.5000
80	1.0000	.0000	2.5000	9.8000	1.2000	.0000
90	.0000	.0000	.7000	1.0000	1.3000	.0000
100	.0000	.0000	.6000	.1000	1.6000	.0000
110	.0000	.0000	.5000	.1000	1.9000	.0000
120	.0000	.0000	.5000	.1000	2.0000	.0000
130	.0000	.0000	.7000	.1000	2.1000	.0000
140	.0000	.0000	.7000	.1000	2.6000	.0000
150	.0000	.0000	.8000	.1000	3.0000	.0000
160	.0000	.0000	.9000	.1000	3.8000	.0000
170	.0000	.0000	.9000	.1000	4.3000	.5000
180	.0000	.0000	1.0000	.1000	5.5000	1.0000
190	.7000	.0000	1.2000	.2000	7.2000	1.9000
200	1.5000	1.5000	1.7000	1.0000	9.7000	4.0000
210	3.0000	2.5000	2.8000	1.7000	12.4000	6.8000
220	6.3000	4.0000	4.3000	3.0000	17.1000	10.1000
230	9.7000	6.7000	6.4000	5.0000	23.0000	17.4000
240	15.2000	11.0000	10.3000	7.7000	28.1000	23.5000
250	21.8000	21.1000	18.0000	10.6000	.0000	.0000
260	.0000	.0000	9.5000	.0000	.0000	.0000
270	.0000	.0000	.9000	.0000	.0000	.0000
280	.0000	.0000	.2000	.0000	.0000	.0000
290	.0000	.0000	.0000	.0000	.0000	.0000
300	.0000	.0000	.0000	.0000	.0000	.0000
310	.0000	.0000	.0000	.0000	.0000	.0000
320	.0000	.0000	.0000	.0000	.0000	.0000
330	.0000	.0000	.0000	.0000	.0000	.0000
340	.0000	.0000	.0000	.0000	.0000	.0000
350	.0000	.0000	.0000	.0000	2.4000	.0000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	K	22	14	19	20	21
CORRELATION	.0000	100 00 .040R	100% 1/16	80% 1/3/16	80% 1/1/8	80% 1/1/16
1-ABS(1-RX/RK)	.0000	.8535	.8711	.7564	.7176	.4225
PRODUCT	.0000	.9256	.6575	.6268	.6404	.5005
MAGNITUDE	.0000	.7900	.5727	.4741	.4596	.2115
SENSITIVITY V/IN	56.8686	61.4429	86.4884	90.7290	88.8041	37.9257
DATA VECTOR - DEG	1.0000	1.0000	2.0000	2.0000	2.0000	2.0000
0	8.9000	5.0000	5.4000	2.0000	.0000	.0000
10	10.8000	7.9000	7.2000	3.2000	2.0000	.0000
20	14.0000	11.3000	9.8000	5.1000	4.0000	.0000
30	17.8000	16.4000	12.9000	8.9000	6.9000	.0000
40	23.2000	22.2000	17.0000	14.9000	11.0000	.0000
50	.0000	28.0000	19.9000	27.0000	18.4000	3.8000
60	.0000	1.1000	.5000	.0000	20.5000	6.2000
70	.0000	1.2000	.5000	.0000	.0000	9.8000
80	.0000	1.3000	.6000	.0000	.0000	1.0000
90	.0000	1.6000	.7000	.0000	.0000	.1000
100	.0000	1.9000	.8000	.0000	.0000	.1000
110	.0000	2.0000	.9000	.0000	.0000	.1000
120	.0000	2.1000	1.1000	.0000	.0000	.1000
130	.0000	2.6000	1.2000	.0000	.0000	.1000
140	.0000	3.0000	1.5000	.0000	.0000	.1000
150	.5000	3.8000	2.0000	.0000	.0000	.1000
160	1.0000	4.3000	2.7000	.5000	.5000	.1000
170	2.3000	5.5000	3.3000	1.0000	1.0000	.1000
180	4.2000	7.2000	4.5000	1.8000	1.9000	.2000
190	7.3000	9.7000	6.1000	3.7000	4.0000	1.0000
200	11.2000	12.4000	8.2000	5.3000	6.8000	1.7000
210	15.7000	17.1000	11.6000	8.0000	10.1000	3.0000
220	22.6000	23.0000	15.9000	14.1000	17.4000	5.0000
230	29.3000	28.1000	16.0000	25.8000	23.5000	7.7000
240	4.0000	.0000	.0000	1.0000	.0000	10.6000
250	2.3000	.0000	.0000	.0000	.0000	.0000
260	1.8000	.0000	.0000	.0000	.0000	.0000
270	1.5000	.0000	.0000	.0000	.0000	.0000
280	1.7000	.0000	.5000	.0000	.0000	.0000
290	2.0000	.0000	1.1000	.0000	.0000	.0000
300	2.7000	.0000	1.3000	.0000	.0000	.0000
310	3.2000	.0000	1.5000	.0000	.0000	.0000
320	3.6000	.0000	1.9000	.0000	.0000	.0000
330	4.5000	.0000	2.6000	.3000	.0000	.0000
340	5.8000	.0000	3.2000	.7000	.0000	.0000
350	7.1000	2.4000	4.2000	1.1000	.0000	.0000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	1	100 OD .04DR	100% 1/16	80% ID 3/16	80% ID 1/8	40% ID 3/16
CORRELATION	.0000	.8337	.8268	.7754	.7174	.4588
1-ABS(1-RX/RK)	.0000	.7836	.5567	.5307	.5422	.6492
PRODUCT	.0000	.6533	.4603	.4115	.3889	.2978
MAGNITUDE	48.1478	61.4429	86.4884	90.7290	88.8041	35.6448
SENSITIVITY V/IN	1.0000	1.0000	2.0000	2.0000	2.0000	1.0000
DATA VECTOR - DEG	0	2.7000	5.0000	2.0000	.0000	1.1000
	10	5.8000	7.9000	3.2000	2.0000	2.0000
	20	9.1000	11.3000	5.1000	4.0000	2.9000
	30	15.6000	16.4000	12.9000	6.9000	4.6000
	40	28.3000	22.2000	17.0000	11.0000	6.8000
	50	.0000	28.0000	19.9000	18.4000	11.2000
	60	.0000	1.1000	.5000	20.5000	20.7000
	70	.0000	1.2000	.5000	.0000	.0000
	80	.0000	1.3000	.6000	.0000	.0000
	90	.0000	1.6000	.7000	.0000	.0000
	100	.0000	1.9000	.8000	.0000	.0000
	110	.0000	2.0000	.9000	.0000	.0000
	120	.0000	2.1000	1.1000	.0000	.0000
	130	.0000	2.6000	1.2000	.0000	.0000
	140	.0000	3.0000	1.5000	.0000	.0000
	150	.0000	3.8000	2.0000	.0000	.0000
	160	.0000	4.3000	2.7000	.5000	.0000
	170	1.8000	5.5000	3.3000	1.0000	.0000
	180	2.2000	7.2000	4.5000	1.8000	.0000
	190	3.8000	9.7000	6.1000	3.7000	1.5000
	200	6.0000	12.4000	8.2000	5.3000	2.5000
	210	9.0000	17.1000	11.6000	8.6000	4.0000
	220	14.7000	23.0000	15.9000	14.1000	6.7000
	230	28.0000	28.1000	16.0000	25.8000	11.0000
	240	.9000	.0000	.0000	1.0000	21.1000
	250	.0000	.0000	.0000	.0000	.0000
	260	.0000	.0000	.0000	.0000	.0000
	270	.8000	.0000	.0000	.0000	.0000
	280	.8000	.0000	.5000	.0000	.0000
	290	.1000	.0000	1.1000	.0000	.0000
	300	.9000	.0000	1.3000	.0000	.0000
	310	.9000	.0000	1.5000	.0000	.0000
	320	1.0000	.0000	1.9000	.0000	.0000
	330	1.1000	.0000	2.6000	.3000	.0000
	340	1.2000	.0000	3.2000	.7000	.0000
	350	1.8000	2.4000	4.2000	1.1000	.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	M	22	1	21	14	5
CORRELATION	.0000	100 ON .04DP	40% ID 1/8	80% ID 1/16	100% 1/16	40% ID 3/16
1-ABS(1-RX/RK)	.0000	.2499	.2017	.1636	.2375	.1225
PRODUCT	.0000	.7021	.7232	.8626	.4988	.7898
MAGNITUDE	.0000	.1755	.1459	.1411	.1185	.0367
SENSITIVITY V/IN	43.1385	61.4429	33.7868	37.9257	86.4884	35.6448
DATA VECTOR - DEG	1.0000	1.0000	1.0000	2.0000	2.0000	1.0000
0	.0000	5.0000	.0000	.0000	5.4000	1.1000
10	.0000	7.9000	.0000	.0000	7.2000	2.0000
20	.0000	11.3000	2.3000	.0000	9.8000	2.9000
30	.0000	16.4000	4.0000	.0000	12.9000	4.6000
40	.0000	22.2000	6.5000	.0000	17.0000	6.8000
50	.0000	28.0000	10.6000	3.8000	19.9000	11.2000
60	.5000	1.1000	19.0000	6.2000	.5000	20.7000
70	1.0000	1.2000	2.5000	9.8000	.5000	.0000
80	1.3000	1.3000	.7000	1.0000	.6000	.0000
90	.9000	1.6000	.6000	.1000	.7000	.0000
100	1.6000	1.9000	.5000	.1000	.8000	.0000
110	4.3000	2.0000	.5000	.1000	.9000	.0000
120	6.8000	2.1000	.7000	.1000	1.1000	.0000
130	14.7000	2.6000	.7000	.1000	1.2000	.0000
140	24.0000	3.0000	.8000	.1000	1.5000	.0000
150	14.4000	3.8000	.9000	.1000	2.0000	.0000
160	9.1000	4.3000	.9000	.1000	2.7000	.0000
170	7.0000	5.5000	1.0000	.1000	3.3000	.0000
180	5.5000	7.2000	1.2000	.2000	4.5000	.0000
190	4.6000	9.7000	1.7000	1.0000	6.1000	1.5000
200	4.1000	12.4000	2.8000	1.7000	8.2000	2.5000
210	3.8000	17.1000	4.3000	3.0000	11.6000	4.0000
220	3.7000	23.0000	6.4000	5.0000	15.9000	6.7000
230	3.7000	28.1000	10.3000	7.7000	16.0000	11.0000
240	3.8000	.0000	18.0000	10.6000	.0000	21.1000
250	4.0000	.0000	9.5000	.0000	.0000	.0000
260	4.2000	.0000	.9000	.0000	.0000	.0000
270	4.7000	.0000	.2000	.0000	.0000	.0000
280	5.6000	.0000	.0000	.0000	.5000	.0000
290	7.3000	.0000	.0000	.0000	1.1000	.0000
300	10.4000	.0000	.0000	.0000	1.3000	.0000
310	16.9000	.0000	.0000	.0000	1.5000	.0000
320	.0000	.0000	.0000	.0000	1.9000	.0000
330	.0000	.0000	.0000	.0000	2.6000	.0000
340	.0000	.0000	.0000	.0000	3.2000	.0000
350	.0000	2.4000	.0000	.0000	4.2000	.0000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	N	13	12	17	1	8
CORRELATION	.0000	40% OD 3/16	40% ID 1/8	50% OD .04DR	40% ID 1/8	20% ID 1/8
1-ABS(1-RX/RK)	.0000	.5921	.6466	.3529	.1207	.1172
PRODUCT	.0000	.6169	.4111	.3087	.7460	.6811
MAGNITUDE	.0000	.3652	.2658	.1089	.0900	.0796
SENSITIVITY V/IN	25.2061	18.2241	15.8639	14.9036	33.7868	19.1114
DATA VECTOR - DEG	0	1.0000	.2000	.5000	1.0000	.5000
	10	1.4000	.8000	.9000	.0000	.5000
	20	1.4000	.9000	1.0000	.0000	.6000
	30	1.4000	1.1000	.2000	2.3000	.8000
	40	1.6000	.1000	.0000	4.0000	.9000
	50	1.9000	.1000	.0000	6.5000	1.2000
	60	2.0000	.2000	.0000	10.6000	4.5000
	70	.0000	.2000	.0000	19.0000	11.0000
	80	.0000	.2000	.0000	2.5000	22.0000
	90	.0000	.2000	.0000	.7000	.0000
	100	.0000	.3000	.0000	.6000	.0000
	110	.0000	.3000	.0000	.5000	1.5000
	120	.0000	.6000	.0000	.5000	1.8000
	130	.0000	1.0000	.0000	.7000	1.8000
	140	.0000	2.0000	.0000	.7000	1.8000
	150	4.5000	7.3000	.0000	.8000	1.8000
	160	7.4000	14.9000	.0000	.9000	1.9000
	170	1.1000	24.1000	7.0000	.9000	2.0000
	180	1.0000	34.1000	10.8000	1.0000	2.1000
	190	.8000	.0000	13.7000	1.2000	2.4000
	200	.7000	.0000	1.0000	1.7000	2.8000
	210	.7000	.0000	.0000	2.8000	3.2000
	220	.8000	.0000	.0000	4.3000	3.8000
	230	.8000	.0000	.0000	6.4000	5.5000
	240	.9000	.0000	.0000	10.3000	7.9000
	250	1.0000	.0000	.0000	18.0000	12.3000
	260	1.0000	.0000	.0000	9.5000	22.8000
	270	1.3000	.0000	.0000	.9000	.0000
	280	4.1000	6.5000	.0000	.2000	1.2000
	290	.0000	9.3000	.0000	.0000	.7000
	300	.0000	12.0000	.0000	.0000	.5000
	310	.0000	15.3000	.0000	.0000	.4000
	320	8.2000	19.4000	.0000	.0000	.4000
	330	15.8000	24.0000	5.0000	.0000	.3000
	340	14.0000	29.1000	7.2000	.0000	.3000
	350	1.5000	33.7000	9.9000	.0000	.3000
		1.5000	28.7000	12.4000	.0000	.4000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	0	1	21	22	3	14
CORRELATION	.0000	40% ID 1/8	80% ID 1/16	100 OD .04DR	40% ID 3/16	100% 1/16
1-ABS(1-RX/RK)	.0000	.1810	.1360	.2167	.1061	.2139
PRODUCT	.0000	.9025	.9777	.6035	.9597	.4287
MAGNITUDE	.0000	.1634	.1329	.1308	.1018	.0917
SENSITIVITY V/IN	37.0800	33.7868	37.9257	61.4429	35.6448	86.4884
DATA VECTOR - DEG	1.0000	1.0000	2.0000	1.0000	1.0000	2.0000
0	.0000	.0000	.0000	5.0000	1.1000	5.4000
10	.0000	.0000	.0000	7.9000	2.0000	7.2000
20	.0000	2.3000	.0000	11.3000	2.9000	9.8000
30	.0000	4.0000	.0000	16.4000	4.6000	12.9000
40	.0000	6.5000	.0000	22.2000	6.8000	17.0000
50	.0000	10.6000	3.8000	28.0000	11.2000	19.9000
60	.0000	19.0000	6.2000	1.1000	20.7000	.5000
70	.0000	2.5000	9.8000	1.2000	.0000	.5000
80	.0000	.7000	1.0000	1.3000	.0000	.6000
90	10.7000	.6000	.1000	1.6000	.0000	.7000
100	12.6000	.5000	.1000	1.9000	.0000	.8000
110	12.8000	.5000	.1000	2.0000	.0000	.9000
120	13.4000	.7000	.1000	2.1000	.0000	1.1000
130	14.5000	.7000	.1000	2.6000	.0000	1.2000
140	13.2000	.8000	.1000	3.0000	.0000	1.5000
150	3.3000	.9000	.1000	3.8000	.0000	2.0000
160	3.0000	.9000	.1000	4.3000	.0000	2.7000
170	2.9000	1.0000	.1000	5.5000	.0000	3.3000
180	2.7000	1.2000	.2000	7.2000	.0000	4.5000
190	2.8000	1.7000	1.0000	9.7000	1.5000	6.1000
200	2.8000	2.8000	1.7000	12.4000	2.5000	8.2000
210	2.8000	4.3000	3.0000	17.1000	4.0000	11.6000
220	2.9000	6.4000	5.0000	23.0000	6.7000	15.9000
230	3.0000	10.3000	7.7000	28.1000	11.0000	16.0000
240	3.1000	18.0000	10.6000	.0000	21.1000	.0000
250	3.3000	9.5000	.0000	.0000	.0000	.0000
260	3.9000	.9000	.0000	.0000	.0000	.0000
270	5.0000	.2000	.0000	.0000	.0000	.0000
280	4.3000	.0000	.0000	.0000	.0000	.5000
290	5.1000	.0000	.0000	.0000	.0000	1.1000
300	5.8000	.0000	.0000	.0000	.0000	1.3000
310	7.2000	.0000	.0000	.0000	.0000	1.5000
320	7.3000	.0000	.0000	.0000	.0000	1.9000
330	7.3000	.0000	.0000	.0000	.0000	2.6000
340	.0000	.0000	.0000	.0000	.0000	3.2000
350	.0000	.0000	.0000	2.4000	.0000	4.2000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	P	11	15	4	20	19
CORRELATION	.0000	100% 3/16	100% 1/8	20% 0D 3/16	80% ID 1/8	80% ID 3/16
1-ABS(1-RX/RK)	.0000	.8295	.8822	.0395	.8094	.8880
PRODUCT	.0000	.9968	.1733	-68.4662	-3.9989	-3.8716
MAGNITUDE	532.7260	.8268	.1529	-2.7061	-3.2365	-3.4379
SENSITIVITY V/IN	10.0000	531.0273	291.6316	7.5600	88.8041	90.7290
DATA VECTOR - DEG	0	10.0000	10.0000	.2000	2.0000	2.0000
10	4.7000	3.7000	2.4000	.0000	.0000	2.0000
20	7.0000	5.2000	3.4000	.0000	2.0000	3.2000
30	10.1000	7.9000	4.9000	.0000	4.0000	5.1000
40	15.7000	11.8000	6.9000	.0000	6.9000	8.9000
50	24.3000	17.0000	9.8000	.0000	11.0000	14.9000
60	18.0000	24.1000	13.2000	.0000	18.4000	27.0000
70	.0000	20.4000	.0000	.0000	20.5000	.0000
80	.0000	1.9000	.0000	.0000	.0000	.0000
90	.0000	.8000	.0000	.0000	.0000	.0000
100	.0000	.6000	.0000	10.0000	.0000	.0000
110	.0000	.1000	.0000	9.4000	.0000	.0000
120	.0000	.1000	.0000	9.6000	.0000	.0000
130	1.1000	.1000	.0000	10.0000	.0000	.0000
140	1.2000	.7000	.0000	10.8000	.0000	.0000
150	1.5000	.9000	.0000	11.8000	.0000	.0000
160	1.9000	1.1000	.0000	.0000	.0000	.0000
170	2.9000	1.6000	.0000	.0000	.5000	.5000
180	4.2000	2.2000	1.1000	.0000	1.0000	1.0000
190	5.7000	3.2000	1.9000	.0000	1.9000	1.8000
200	7.7000	4.9000	3.0000	.0000	4.0000	3.7000
210	11.0000	7.0000	4.5000	.0000	6.8000	5.3000
220	16.1000	10.4000	6.4000	.0000	10.1000	8.6000
230	25.2000	15.9000	9.9000	.0000	17.4000	14.1000
240	18.3000	24.5000	13.8000	.0000	23.5000	25.8000
250	.0000	15.0000	11.0000	.0000	.0000	1.0000
260	.0000	.0000	1.6000	9.9000	.0000	.0000
270	.0000	.0000	.6000	10.9000	.0000	.0000
280	.0000	.0000	.4000	7.2000	.0000	.0000
290	.0000	.0000	.2000	8.7000	.0000	.0000
300	.0000	.0000	.2000	10.0000	.0000	.0000
310	1.0000	.0000	.2000	11.2000	.0000	.0000
320	1.2000	.0000	.1000	12.9000	.0000	.0000
330	1.5000	.0000	.1000	7.5000	.0000	.0000
340	2.0000	1.0000	.1000	.0000	.0000	.3000
350	2.4000	1.3000	1.0000	.0000	.0000	.7000
	3.6000	2.2000	1.6000	.0000	.0000	1.1000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	Q	100% 1/8	100% 3/16	80% 1/2 3/16	100% 1/16	80% 1/8
CORRELATION	.0000	.6989	.6396	.6316	.8332	.6106
1-ABS(1-RX/RK)	.0000	.5331	.2928	.2865	.2025	.2494
PRODUCT	.0000	.3726	.1872	.1810	.1687	.1523
MAGNITUDE	155.4638	291.6316	531.0273	90.7290	86.4884	88.8041
SENSITIVITY V/IN	10.0000	10.0000	10.0000	2.0000	2.0000	2.0000
DATA VECTOR - DEG	0	1.3000	2.4000	3.7000	2.0000	5.4000
	10	2.2000	3.4000	5.2000	3.2000	7.2000
	20	3.2000	4.9000	7.9000	5.1000	9.8000
	30	5.0000	6.9000	11.8000	8.9000	12.9000
	40	7.7000	9.8000	17.0000	14.9000	17.0000
	50	2.0000	13.2000	24.1000	27.0000	19.9000
	60	.0000	.0000	20.4000	.0000	.5000
	70	.0000	.0000	1.9000	.0000	.5000
	80	.0000	.0000	.8000	.0000	.6000
	90	.0000	.0000	.6000	.0000	.7000
	100	.0000	.0000	.1000	.0000	.8000
	110	.0000	.0000	.1000	.0000	.9000
	120	.0000	.0000	.1000	.0000	1.1000
	130	.0000	.0000	.7000	.0000	1.2000
	140	.0000	.0000	.9000	.0000	1.5000
	150	.0000	.0000	1.1000	.0000	2.0000
	160	.0000	.0000	1.6000	.5000	2.7000
	170	1.8000	1.1000	2.2000	1.0000	3.3000
	180	1.9000	1.9000	3.2000	1.8000	4.5000
	190	3.0000	3.0000	4.9000	3.7000	6.1000
	200	4.1000	4.5000	7.0000	5.3000	8.2000
	210	5.8000	6.4000	10.4000	8.6000	11.6000
	220	8.3000	9.9000	15.9000	14.1000	15.9000
	230	.0000	13.8000	24.5000	25.8000	16.0000
	240	.0000	11.0000	15.0000	1.0000	.0000
	250	.0000	1.6000	.0000	.0000	.0000
	260	.0000	.6000	.0000	.0000	.0000
	270	.0000	.4000	.0000	.0000	.0000
	280	.0000	.2000	.0000	.0000	.0000
	290	.0000	.2000	.0000	.0000	.0000
	300	.0000	.2000	.0000	.0000	.0000
	310	.0000	.1000	.0000	.0000	.0000
	320	.0000	.1000	.0000	.0000	.0000
	330	.0000	.1000	1.0000	.3000	2.6000
	340	.0000	1.0000	1.3000	.7000	3.2000
	350	1.2000	1.6000	2.2000	1.1000	4.2000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	R	12	13	8	17	23
CORRELATION	.0000	40% ID 1/8	40% OD 3/16	20% ID 1/8	50% OD .04DR	100 OD .02DR
1-ABS(1-RX/RK)	.0000	.6373	.4884	.3007	.3991	.4199
PRODUCT	.0000	.7139	.8805	.9325	.6311	.5582
MAGNITUDE	.0000	.4550	.4300	.2804	.2519	.2344
SENSITIVITY V/IN	20.4018	15.8639	18.2241	19.1114	14.9036	14.1506
DATA VECTOR - DEG	0	.2000	.2000	.5000	.5000	.5000
10	.0000	.9000	.8000	.5000	14.3000	4.4000
20	.0000	.9000	.9000	.6000	1.0000	5.6000
30	.0000	.1000	1.1000	.8000	.2000	6.9000
40	.0000	.1000	1.3000	.9000	.0000	9.2000
50	.0000	.1000	2.2000	1.2000	.0000	11.6000
60	.0000	.1000	4.2000	4.5000	.0000	1.0000
70	.0000	.2000	7.9000	11.0000	.0000	.0000
80	.0000	.2000	10.0000	22.0000	.0000	.0000
90	2.5000	.3000	11.9000	.0000	.0000	.0000
100	4.0000	.3000	13.8000	.0000	.0000	2.1000
110	5.8000	.6000	15.7000	1.5000	.0000	2.2000
120	8.2000	1.0000	18.8000	1.8000	.0000	2.2000
130	12.9000	2.0000	22.2000	1.8000	.0000	2.2000
140	18.0000	7.3000	26.9000	1.8000	.0000	2.3000
150	27.8000	14.9000	32.6000	1.8000	.0000	2.6000
160	41.0000	24.1000	40.8000	1.9000	.0000	2.6000
170	36.9000	34.1000	19.5000	2.0000	7.0000	2.9000
180	25.0000	.0000	.0000	2.1000	10.8000	3.3000
190	18.0000	.0000	.0000	2.4000	13.7000	4.1000
200	14.5000	.0000	.0000	2.8000	1.0000	5.1000
210	12.0000	.0000	.0000	3.2000	.0000	6.4000
220	10.9000	.0000	.0000	3.8000	.0000	8.2000
230	10.0000	.0000	.0000	5.5000	.0000	10.1000
240	10.0000	.0000	.0000	7.9000	.0000	12.3000
250	14.4000	.0000	.0000	12.3000	.0000	.8000
260	16.6000	.0000	.0000	22.8000	.0000	.0000
270	19.4000	6.5000	.0000	.0000	.0000	.0000
280	21.2000	9.3000	.0000	1.2000	.0000	.0000
290	22.8000	12.0000	.0000	.7000	.0000	.0000
300	24.9000	15.3000	.0000	.5000	.0000	.0000
310	28.0000	19.4000	8.8000	.4000	.0000	.6000
320	33.5000	24.0000	14.2000	.4000	.0000	1.2000
330	.0000	29.1000	19.9000	.3000	5.0000	1.5000
340	.0000	33.7000	27.3000	.3000	7.2000	2.1000
350	.0000	28.7000	37.9000	.3000	9.9000	2.8000
			.9000	.4000	12.4000	3.3000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

VARIABLE NUMBER	UNKNOWN	M(1) 12	M(2) 17	M(3) 13	M(4) 16	M(5) 23
VARIABLE NAME	S	40% ID 1/8	50% OD .04DR	40% OD 3/16	80.00 .02DR	100 OD .02DR
CORRELATION	.0000	.9855	.6368	.6137	.6667	.2726
1-ABS(1-RX/RK)	.0000	.9759	.9612	.8495	.5420	.9060
PRDUCT	.0000	.9617	.6122	.5213	.3614	.2469
MAGNITUDE	15.4613	15.8639	14.9036	16.2241	10.6184	14.1506
SENSITIVITY V/IN	.2000	.2000	.5000	.2000	.2000	.5000
DATA VECTOR - DEG	0	4.0000	.9000	14.3000	.8000	17.6000
	10	5.0000	.9000	1.0000	.9000	21.1000
	20	.0000	.1000	.2000	1.1000	1.0000
	30	.0000	.1000	.0000	1.3000	.4000
	40	.0000	.1000	.0000	2.2000	.0000
	50	.0000	.1000	.0000	4.2000	.0000
	60	.0000	.2000	.0000	7.9000	.0000
	70	.0000	.2000	.0000	10.0000	.0000
	80	.0000	.2000	.0000	11.9000	.0000
	90	.0000	.3000	.0000	13.3000	.0000
	100	.0000	.3000	.0000	15.7000	.9000
	110	.0000	.6000	.0000	18.8000	3.5000
	120	.0000	1.0000	.0000	22.2000	5.9000
	130	.0000	2.0000	.0000	26.9000	7.8000
	140	5.6000	7.3000	.0000	32.6000	9.3000
	150	13.7000	14.9000	.0000	40.8000	11.2000
	160	25.0000	24.1000	7.0000	19.5000	13.0000
	170	28.6000	34.1000	10.8000	.0000	14.9000
	180	.0000	.0000	13.7000	.0000	17.1000
	190	.0000	.0000	1.0000	.0000	19.2000
	200	.0000	.0000	.0000	.0000	1.8000
	210	.0000	.0000	.0000	.0000	.6000
	220	.0000	.0000	.0000	.0000	.0000
	230	.0000	.0000	.0000	.0000	.0000
	240	.0000	.0000	.0000	.0000	.0000
	250	.0000	.0000	.0000	.0000	.0000
	260	.0000	.0000	.0000	.0000	.0000
	270	8.9000	6.5000	.0000	.0000	.0000
	280	11.7000	9.3000	.0000	.0000	.0000
	290	14.2000	12.0000	.0000	.0000	.0000
	300	17.4000	15.3000	.0000	6.8000	7.2000
	310	21.5000	19.4000	.0000	14.2000	7.9000
	320	26.0000	24.0000	5.0000	19.9000	8.8000
	330	30.5000	29.1000	7.2000	27.3000	10.0000
	340	33.4000	33.7000	9.9000	37.9000	12.0000
	350	19.6000	28.7000	12.4000	.9000	14.2000

CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX II

VARIABLE NUMBER	UNKNOWN	M(1)	M(2)	M(3)	M(4)	M(5)
VARIABLE NAME	T	40% OD 1/16	50% OD .02DR	80 OD .02DR	20% OD 1/16	40% ID 1/8
CORRELATION	.0000	.9142	.5674	.6445	.5752	.7081
1-ABS(1-RX/RK)	.0000	.9907	.9728	.6889	.6557	.4611
PRODUCT	.0000	.9057	.5520	.4440	.3771	.3265
MAGNITUDE	7.3150	7.3838	7.5194	10.6184	5.4415	15.8639
SENSITIVITY V/IN	.2000	.2000	.2000	.2000	.2000	.2000
DATA VECTOR - DEG	0	2.0000	2.5000	8.8000	17.6000	7.0000
	10	1.9000	2.3000	9.0000	21.1000	7.0000
	20	1.9000	2.1000	9.0000	1.0000	6.7000
	30	1.9000	2.0000	8.4000	.4000	6.3000
	40	2.0000	.0000	7.4000	.0000	6.2000
	50	2.0000	.0000	6.8000	.0000	6.4000
	60	2.2000	.0000	6.3000	.0000	7.1000
	70	2.7000	.0000	6.0000	.0000	8.6000
	80	4.3000	.0000	5.9000	.0000	6.0000
	90	.0000	.0000	5.9000	.0000	5.3000
	100	.0000	.0000	6.0000	.9000	5.3000
	110	5.0000	.0000	6.1000	3.5000	5.5000
	120	7.2000	5.0000	6.6000	5.9000	5.9000
	130	9.1000	7.5000	7.0000	7.8000	6.5000
	140	11.1000	9.9000	8.0000	9.3000	7.4000
	150	13.7000	12.4000	9.1000	11.2000	7.8000
	160	16.0000	15.1000	.0000	13.0000	5.9000
	170	10.0000	15.8000	.0000	14.9000	.0000
	180	.9000	.0000	.0000	17.1000	.0000
	190	1.0000	.0000	.0000	19.2000	.0000
	200	1.1000	.0000	.0000	1.8000	.0000
	210	1.5000	.0000	.0000	.6000	.0000
	220	2.0000	.0000	.0000	.0000	.0000
	230	2.5000	.0000	.0000	.0000	.0000
	240	4.5000	.0000	.0000	.0000	.0000
	250	7.2000	.0000	.0000	.0000	.0000
	260	.0000	.0000	.0000	.0000	.0000
	270	.0000	.0000	2.5000	.0000	.0000
	280	.0000	.0000	7.8000	.0000	.0000
	290	.0000	.0000	8.1000	.0000	.0000
	300	.0000	.0000	8.3000	.0000	.0000
	310	.0000	.0000	8.1000	.0000	.0000
	320	.0000	.0000	8.1000	.0000	.0000
	330	9.2000	9.4000	8.1000	10.0000	.0000
	340	14.3000	14.9000	8.5000	12.0000	.0000
	350	9.0000	14.9000	8.6000	14.2000	2.0000

APPENDIX II
CORRESPONDENCE OF RANDOM PATTERNS WITH STANDARD PATTERNS

APPENDIX III
Eddy Current Tubing Flaw Patterns
Intentional Flaws

APPENDIX III
Eddy Current Tubing Flaw Patterns
Intentional Flaws

20% ID Notch
0.0625" Long

1.0 V/Inch

40% OD Notch
0.1875" Long

0.8 V/cm

40% OD Notch
0.0625" Long

0.4 V/Inch

100% Notch
0.0625" Long

4 V/Inch

100% Notch
0.1875" Long

20 V/Inch

100% Notch
0.125" Long

20 V/Inch

40% OD Notch
0.125" Long

0.8 V/Inch

80% OD Drill Hole
0.020"

0.4 V/Inch

APPENDIX III
Eddy Current Tubing Flaw Patterns
Intentional Flaws

50% OD Drill Hole 1.0 V/Inch
0.040"

80% ID Notch 4 V/Inch
0.0625" Long

50% OD Drill Hole 0.4 V/Inch
0.020"

100% OD Drill Hole 2 V/Inch
0.040"

80% ID Notch 4 V/Inch
0.1875" Long

100% OD Drill Hole 1.0 V/Inch
0.020"

80% ID Notch 4 V/Inch
0.125" Long

17
Q

19
S

18
R

20
T

APPENDIX IV
Eddy Current Tubing Flaw Patterns
Random Flaws

PROGRAM LOCATE WAS WRITTEN BY MRS. CAROL L. LEWIS
APPLIED MATHEMATICS
BATTELLE-NORTHWEST

DIMENSION R(41,23),RX(41),ID(23,2),M(5),ND(5,3)	0001
101 FORMAT (1H1)	0002
1 FORMAT (4X,2A6,29X,F5.2,10F3.1/2X,26F3.1)	0003
2 FORMAT (A2,43X,F5.2,10F3.1/2X,26F3.1)	0004
100 FORMAT (1H1,34X,7HUNKNOWN,11X,5(2HM(,11,1H),11X))	0005
99 FORMAT (5X,15HVARIBLE NUMBER ,33X,5(12,13X))	0006
98 FORMAT (5X,3A6,8X,6(F10.4,5X))	0007
97 FORMAT (5X,19HDATA VECTOR - DEG ,13,4X,6(F10.4,5X))	0008
96 FORMAT (24X,13,4X,6(F10.4,5X))	0009
95 FORMAT (5X,13HVARIBLE NAME ,20X,A2,7X,5(2A6,3X))	0010
CALL SETEOF (\$1000)	0011
DATA ((ND(I,J),J=1,3),I=1,5)/6HCORREL,6HATION ,6H ,6H1-ABS(,	0012
16H1-RX/R,6HK) ,6HPRODUC,6HT ,6H ,6HMAGNIT,6HTUDE ,	0013
26H ,6HSENSIT,6HIVITY ,6HV/IN /	0014
DO 11 I=1,23	0015
S=0	0016
READ (5,1) (ID(I,K),K=1,2),(R(J,I),J=5,41)	0017
DO 10 J=6,41	0018
X=R(J,I)	0019
10 S=S+X*X	0020
11 R(4,I)=SQRT(S)*R(5,I)	0021
22 READ (5,2) IX,(RX(J),J=5,41)	0022
S=0	0023
DO 12 J=6,41	0024
Y=RX(J)	0025
12 S=S+Y*Y	0026
RX(4)=SQRT(S)*RX(5)	0027
DO 14 I=1,23	0028
S=0	0029
DO 13 J=6,41	0030
13 S=S+RX(J)*R(J,I)	0031
R(1,I)=S*RX(5)*R(5,I)/(RX(4)*R(4,I))	0032
R(2,I)=1.-ABS(1.-RX(4)/R(4,I))	0033
14 R(3,I)=R(1,I)*R(2,I)	0034
DO 21 I=1,5	0035
K=I-1	0036

COMPUTER PROGRAM LISTING

APPENDIX V

-41-

BNML-942

APPENDIX V

COMPUTER PROGRAM LISTING

M(I)=0	0037
T=-1.E30	0038
ASSIGN 16 TO II	0039
IF (I.EQ.1) ASSIGN 18 TO II	0040
DO 20 J=1,23	0041
GO TO II	0042
16 DO 17 L=1,K	0043
IF (J.EQ.M(L)) GO TO 20	0044
17 CONTINUE	0045
18 IF (T-R(3,J)) 19,19,20	0046
19 T=R(3,J)	0047
M(I)=J	0048
20 CONTINUE	0049
21 CONTINUE	0050
KK=0	0051
M1=M(1)	0052
M2=M(2)	0053
M3=M(3)	0054
M4=M(4)	0055
M5=M(5)	0056
WRITE (6,100) (I,I=1,5)	0057
WRITE (6,99) (M(J),J=1,5)	0058
WRITE (6,95) IX,(ID(M1,J),J=1,2),(ID(M2,J),J=1,2),(ID(M3,J),J=1,2)	0059
1 , (ID(M4,J),J=1,2),(ID(M5,J),J=1,2)	0060
DO 30 J=1,5	0061
30 WRITE (6,98) (ND(J,I),I=1,3),RX(J),R(J,M1),R(J,M2),R(J,M3),	0062
1R(J,M4),R(J,M5)	0063
WRITE (6,97) KK,RX(6),R(6,M1),R(6,M2),R(6,M3),R(6,M4),R(6,M5)	0064
DO 31 J=7,41	0065
KK=KK+10	0066
31 WRITE (6,96) KK,RX(J),R(J,M1),R(J,M2),R(J,M3),R(J,M4),R(J,M5)	0067
GO TO 22	0068
000 CONTINUE	0069
WRITE (6,101)	0070
STOP	0071
END	0072

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