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EMF AND ELECTROMAGNETIC RADIATION PARAMETER DECISION. (BASED ON TAGUCHI ANALYSIS.)

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Abstract*:* Electromotive force generates electromagnetic radiation. It is therefore necessary to study the mathematical equations related to electromotive force. This paper focuses on electromagnetic radiation generated due to electromotive force . Depending upon the mathematical equations governing emf, certain parameters affecting electromagnetic radiation are decided based on Taguchi Analysis. Taguchi analysis is carried out for only those factors which affect and cause more electromagnetic radiation. Accordingly after carrying out Taguchi analysis , a condition is finalized so that it causes least electromagnetic iation. This condition is optimum condition which can be applied in any situation . It can also take care of human health as more electromagnetic radiation is harmful to human health.

Keywords—

Electromagnetic Radiation; Electromagnetic flux

I. INTRODUCTION

In 1831, Faraday proved that current can be produced by magnetism. He wound two separate windings on an iron toroid and placed a galvanometer in one circuit and a battery in the other. Upon closing the battery circuit , he noted a momentary deflection of the galvanometer, a similar deflection in the opposite direction occurred when the battery was disconnected. This of course was the first experiment he had made involving a changing magnetic field, and he followed it with a demonstration that either a moving magnetic field or a moving coil could also produce galvanometer deflection.

In terms of fields, we can say that a time varying magnetic field produces an electromotive force (emf) which may establish a current in a suitable closed circuit.

An electromotive force is merely a voltage that arises from conductors moving in a magnetic field or from changing magnetic fields. Faraday's law is stated as

Emf= $-d\Phi/dt$ V.-------(1)

Above equation implies a closed path, although not necessarily a closed conducting path. The magnetic flux is that flux which passes through any and every surface whose perimeter is the closed path, and $d\Phi/dt$ is the time rate of change of this flux.

A non zero value of $d\Phi/dt$ may result from any of the following situations:

1. A time – changing flux linking a stationary closed path
2. Relative motion between a steady flux and a closed path.
3. A combination of the two.

The minus sign is an indication that the emf is in such a direction as to produce a current whose flux , if added to the original flux , would reduce the magnitude of the emf. This statement that the induced voltage acts to produce an opposing flux is known as Lenz's law.

Emf is also expressed as

Emf = $\int E.dL$--------(2)

Note that it is the voltage about a specific closed path. If any part of the path is changed, the emf in general changes.

Emf is also denoted as

Emf= $\int E.dL = -d/dt \int_s B.dS$ ---------(3)

The fingers of our right hand indicate the direction of closed path and our thumb indicates the direction of dS. A flux density B in the direction of dS and increasing with time thus produces an average value of E which is opposite to the positive direction about the closed path.

We first consider a stationary path. The magnetic flux is the only time varying quantity on the right side of (3) , and a partial derivative may be taken under the integral sign ,

$$Emf= \int E.dL = -\int_s \partial B/\partial t.dS \text{ ---------(4)}$$

Applying Stoke's theorem to the closed line integral , we have

$$\int_s(\Delta xE).dS= -\int_s \partial B/\partial t.dS$$

Where the surface integrals may be taken over identical surfaces. The surfaces are perfectly general and may be chosen as differentials,

$$(\Delta xE) .dS= - \partial B/\partial t.dS \text{ ----------(5)}$$

And

$$\Delta xE= - \partial B/\partial t \text{ -----------(6)}$$

This is one of Maxwell's four equations as written in differential ,or point form .

Equation 5 is the integral form of this equation and is equivalent to Faraday's law as applied to a fixed path.If B is not a function of time ,(5) and (6) evidently reduce to the electrostatic equations,

$$\int E.d L = 0 \text{ (Electrostatics)}$$

And

$$\Delta xE= 0 \text{ (electrostatics)}$$

As an example of the interpretation of (5) and (6) , let us assume a simple magnetic field which increases exponentially with time within the cylindrical region $\rho < b$,

$$B= B_0e^{kt}a_z \text{ ----------(7)}$$

Where

B_0 = constant.

Choosing the circular path $\rho=a$, $a<b$ in the z=0 plane , along which E_Φ must be constant by symmetry, we then have from (4)

$$Emf=2\Pi aE_\Phi = -kB_0e^{kt}\Pi a^2 \text{--------------(8)}$$

If we replace a by ρ, $\rho< b$, the electric field intensity at any point is

$$E= -1/2\ k\ B_0e^{kt}\ \rho\ a_\Phi \text{ -----------------(9)}$$

2. Modelling of system:

The basic system is radiation measurement system. Depending on the equations governing electromotive force(emf) first the parameters affecting are decided according to priority. Thus following parameters which affect emf the most are decided.

1. Flux density
2. Time
3. Electric field intensity
4. Distance

However more study reveals that electric field intensity and flux density equally are responsible for emf, hence any one can be considered hence we will consider flux density, time and distance as three parameters.

Another important thing is that it is proved that plants/trees reduce emf.

Hence in our system we will measure emf nearby plants/trees.

The system will measure radiation at two different values of time, distance and flux density in an area without plants/ trees, and similarly it will measure radiation at two different values of time, distance and flux density in an area having plants/trees.

The system will also record radiation values at early morning, afternoon and night.

The system will also record radiation values in different climate i.e hot, cold and rainy. also in airy atmosphere radiation values can be measured.

A detailed analysis of all above measurements will be done to reach some definite conclusions. Thereafter an optimum condition can be decided to have less amount of radiation.

3. Results and Discussions:

During experimentation following readings were taken.

Table 1

parameters	Minimum and max values	Mean value of Radiation measured at minimum values	Mean value of Radiation measured at maximum values
Rainy atmosphere (at home)	32 µTesla,35 µTesla	33.565 µTesla	23.098 µTesla
Rainy atmosphere (outside home)	34 µTesla, 36 µTesla	33.86µTesla	35 µTesla
Without gomutra bottle (at 7 p.m)	37.94 µTesla,,42.84 µTesla,	37.94 µTesla,	42.84 µTesla,
With gomutra bottle (at 7 p.m)	37.5 µTesla,38.2 µTesla,	37.82 µTesla,	42.51 µTesla,

Each experiment is repeated 15 times and then mean value of radiation is decided in above tables.

Table 3

parameters	Mean value of Radiation measured at minimum values during day time	Mean value of Radiation measured at maximum values during evening.
Radiation near plants such as aloe vera and cactus	33.86 µTesla(for aloe vera) 33.47 µTesla(for cactus)	38.53 µTesla(for aloe vera) 39.47 µTesla(for cactus)

Table 4

Direction	Mean value of Radiation
EAST	42.47 µTesla
WEST	40.07 µTesla
NORTH	40.67 µTesla
SOUTH	40.73 µTesla

The above readings are taken at evening time at 7.15 pm.

Table 5 : readings taken at 7 p.m evening with and without gomutra bottle.

Direction	Mean value of Radiation With gomutra bottle	Mean value of Radiation Without gomutra bottle
EAST	37.82 µTesla	37.94 µTesla
WEST	41.66 µTesla	41.75 µTesla
NORTH	42.51 µTesla	42.84 µTesla
SOUTH	37.92 µTesla	38.32Tesla

Conclusions:

It is a common observation that in evening , emf is highest in east direction ,it is lowest in west , in north and south direction emf is high.

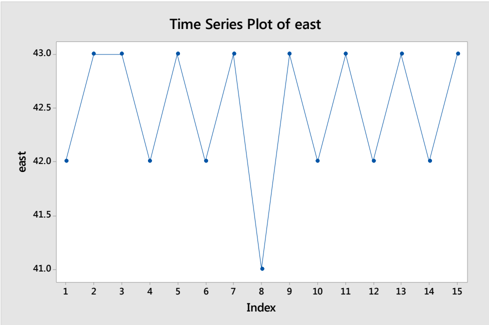
In morning emf is least in east direction and high in west.

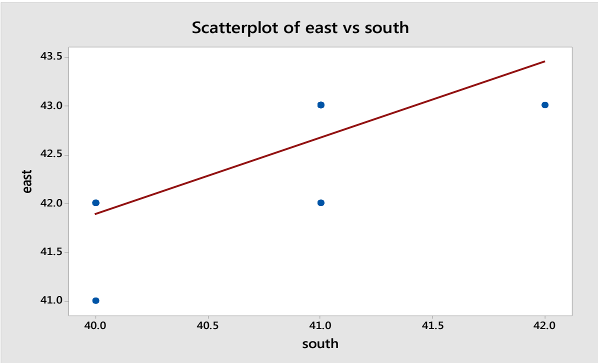
The emf is less than the emf outside home near the plants such as aloe- vera and cactus during day time. However it increases than emf outside home near plants such as aloe- vera and cactus. This indicates that during day time such plants absorb radiation and serve to minimise radiation in atmosphere.

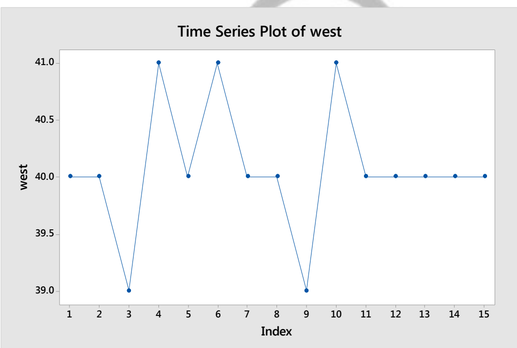
Emf is different at different times and in different seasons also it varies. In hot atmosphere emf values are high.

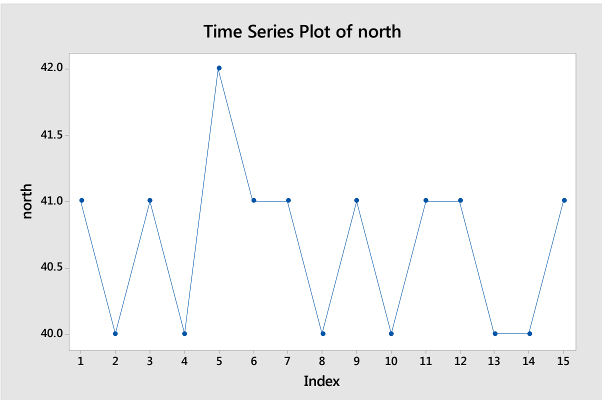
In cold atmosphere emf is low.

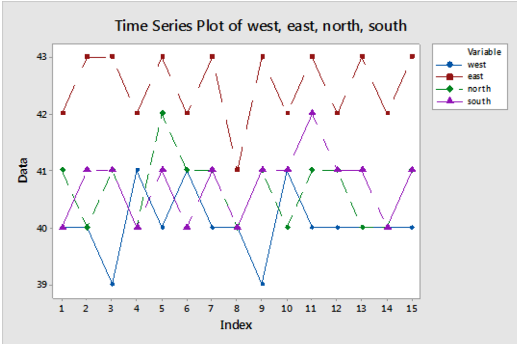
EMF decreases due to gomutra bottle as seen by readings in table 5.
Hence gomutra has capacity to decrease radiation.

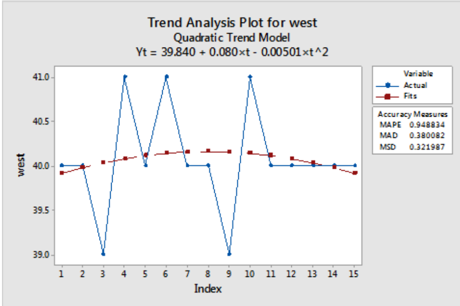


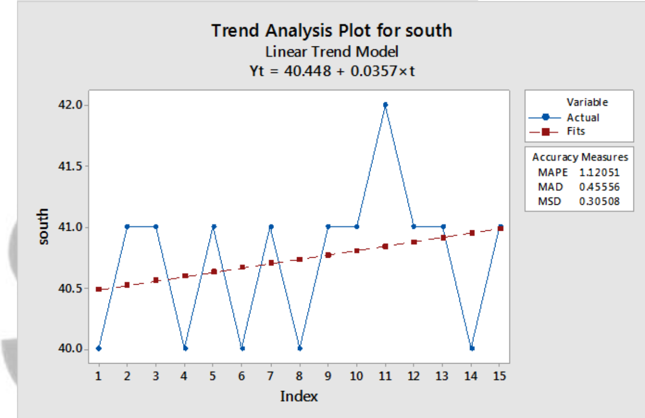


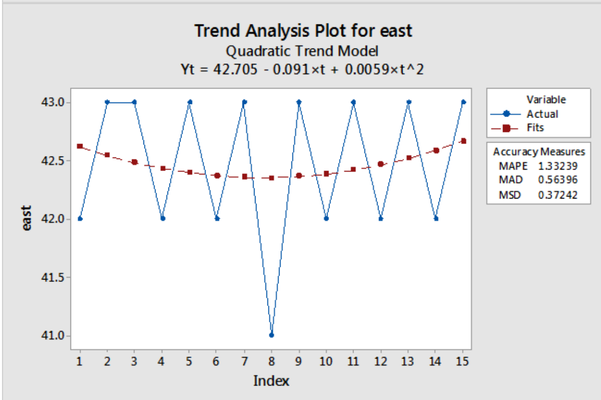


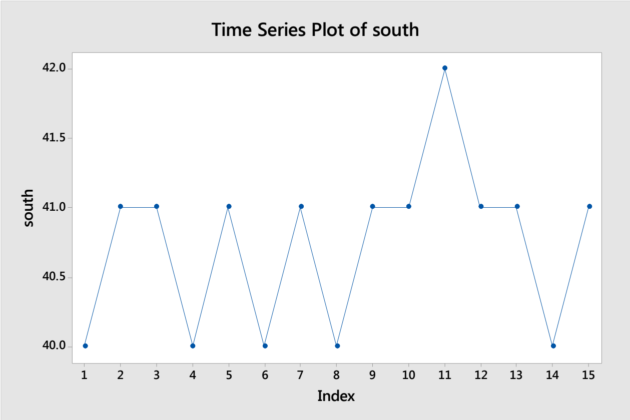


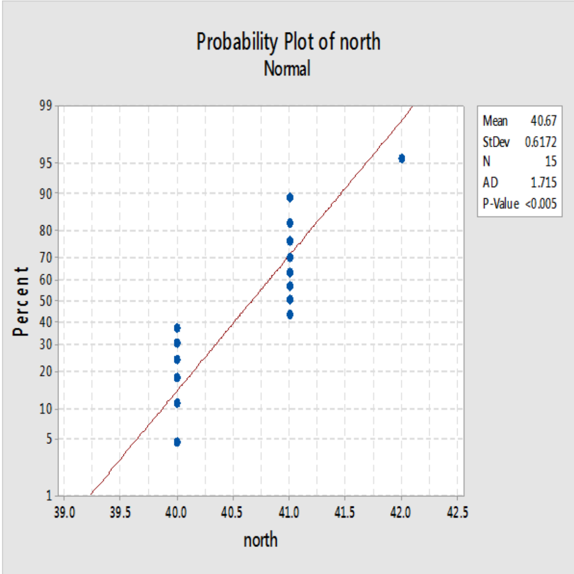


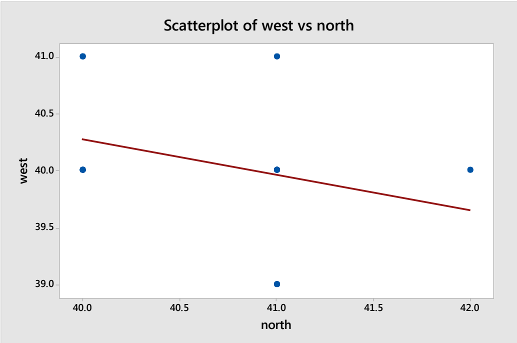


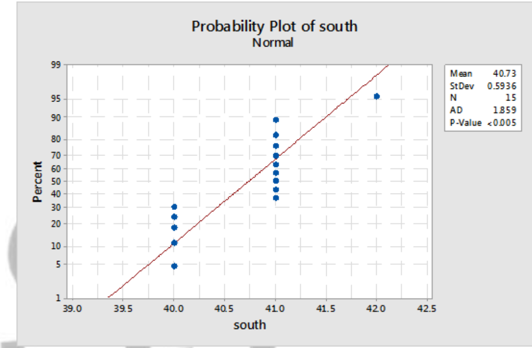


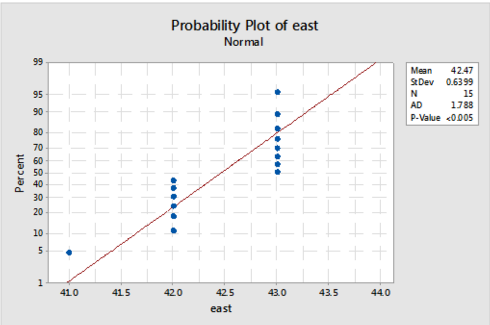


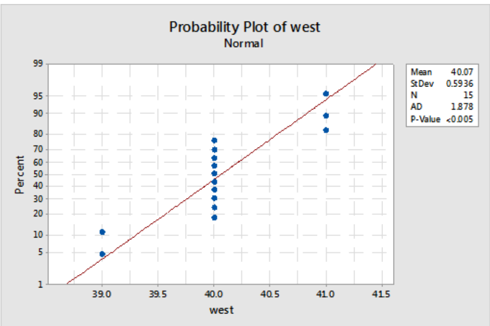

Time Series Plot of south
south
Index

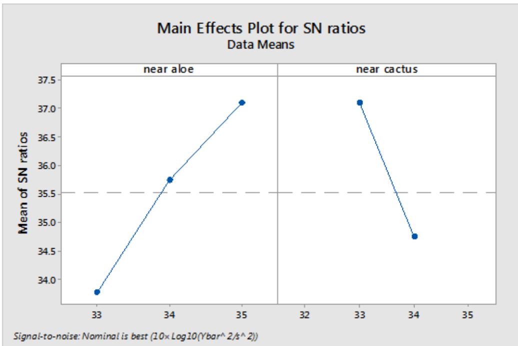

Probability Plot of north
Normal
Mean 40.67
StDev 0.6172
N 15
AD 1.715
P-Value <0.005
Percent
north

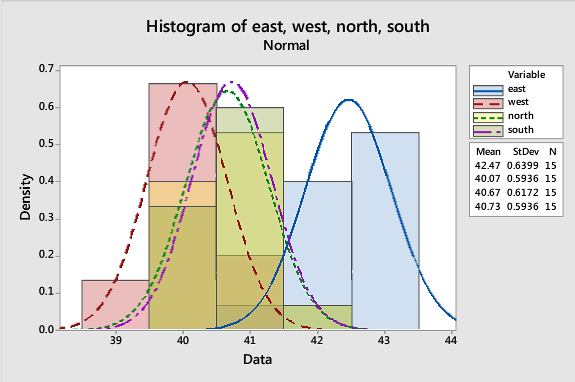

Scatterplot of west vs north
west
north


Probability Plot of south
Normal
Mean 40.73
StDev 0.5936
N 15
AD 1.859
P-Value <0.005
Percent
south

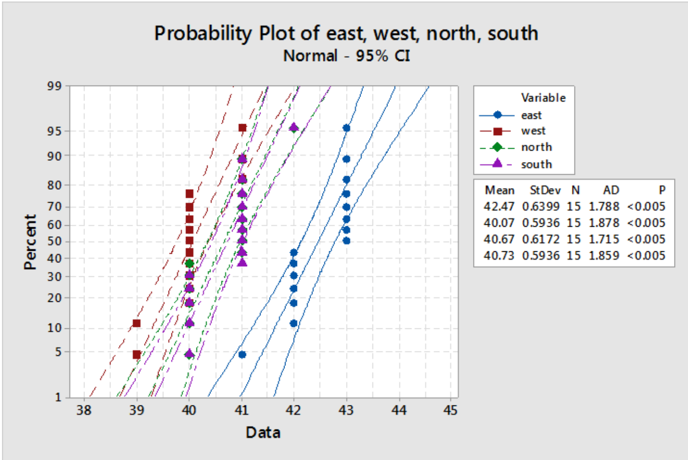

Probability Plot of east
Normal
Mean 42.47
StDev 0.6399
N 15
AD 1.788
P-Value <0.005
Percent
east

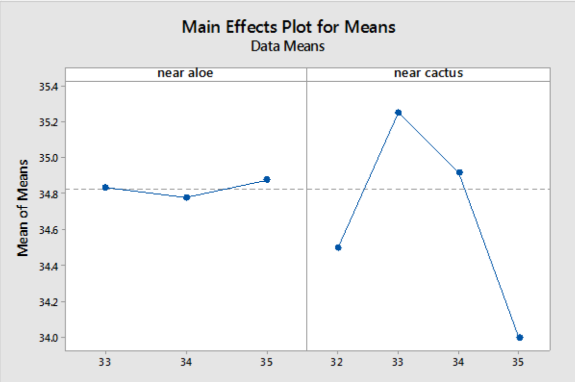

Probability Plot of west
Normal
Mean 40.07
StDev 0.5936
N 15
AD 1.878
P-Value <0.005
Percent
west

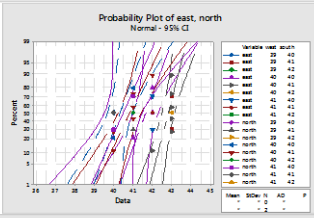

Main Effects Plot for SN ratios
Data Means
near aloe
near cactus
Mean of SN ratios
Signal-to-noise: Nominal is best (10×Log10(Ybar^2/s^2))

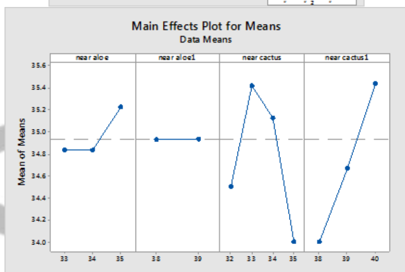


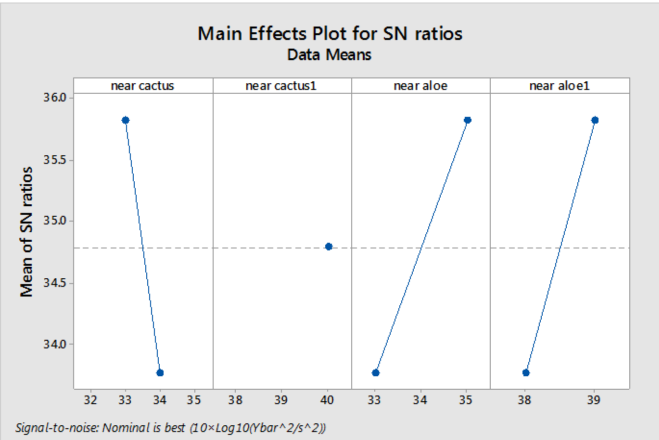
From above graph it is clear that all points lie in a balanced way above average value of 0.64.

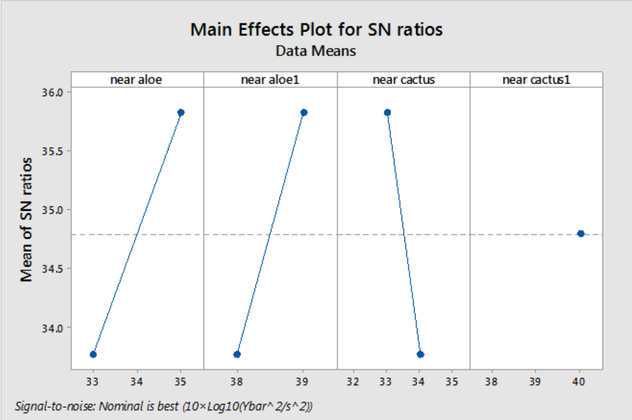


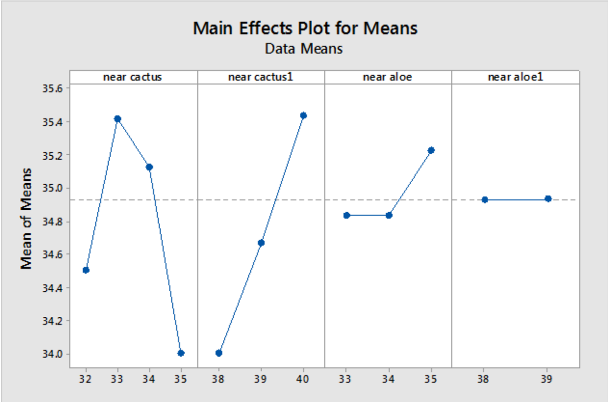












Pareto Chart of outside by near aloe

Nested ANOVA: near cactus, near cactus1, near aloe, near aloe1

Nested ANOVA: near cactus versus outside

Analysis of Variance for near cactus

Source	DF	SS	MS
outside	2	1.5548	0.7774
Error	12	10.1786	0.8482
Total	14	11.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	-0.015*	0.00	0.000
Error	0.848	100.00	0.921
Total	0.848		0.921

* Value is negative, and is estimated by zero.

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near cactus1 versus outside

Analysis of Variance for near cactus1

Source	DF	SS	MS
outside	2	2.0190	1.0095
Error	12	3.7143	0.3095
Total	14	5.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.146	32.03	0.382
Error	0.310	67.97	0.556
Total	0.455		0.675

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near aloe versus outside

Analysis of Variance for near aloe

Source	DF	SS	MS
outside	2	2.7548	1.3774
Error	12	6.1786	0.5149
Total	14	8.9333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.180	25.87	0.424
Error	0.515	74.13	0.718
Total	0.695		0.833

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near aloe1 versus outside

Analysis of Variance for near aloe1

Source	DF	SS	MS
outside	2	0.5548	0.2774
Error	12	3.1786	0.2649
Total	14	3.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.003	0.97	0.051
Error	0.265	99.03	0.515
Total	0.267		0.517

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

General Linear Model: near cactus versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source DF Adj SS Adj MS F-Value P-Value

outside	2	1.555	0.7774	0.92	0.426
Error	12	10.179	0.8482		
Total	14	11.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.920985	13.25%	0.00%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	33.512	0.246	136.15	0.000	
outside					
34	0.488	0.362	1.35	0.203	1.24
35	-0.226	0.318	-0.71	0.490	1.24

Regression Equation

near cactus = 33.512 + 0.488 outside_34 - 0.226 outside_35 - 0.262 outside_36

Fits and Diagnostics for Unusual Observations

Obs	near cactus	Fit	Resid	Std Resid	
14	32.000	34.000	-2.000	-2.51	R

R Large residual

General Linear Model: near cactus1 versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.019	1.0095	3.26	0.074
Error	12	3.714	0.3095		
Total	14	5.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.556349	35.22%	24.42%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	39.476	0.149	265.49	0.000	
outside					
34	-0.476	0.219	-2.18	0.050	1.24
35	-0.048	0.192	-0.25	0.808	1.24

Regression Equation

near cactus1 = 39.476 - 0.476 outside_34 - 0.048 outside_35 + 0.524 outside_36

Fits and Diagnostics for Unusual Observations

Obs	near cactus1	Fit	Resid	Std Resid	
12	40.000	39.000	1.000	2.08	R
14	38.000	39.000	-1.000	-2.08	R

R Large residual

General Linear Model: near aloe versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.755	1.3774	2.68	0.109
Error	12	6.179	0.5149		
Total	14	8.933			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.717552	30.84%	19.31%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	34.155	0.192	178.10	0.000	
outside					
34	-0.155	0.282	-0.55	0.594	1.24
35	-0.440	0.248	-1.78	0.101	1.24

Regression Equation

near aloe = 34.155 - 0.155 outside_34 - 0.440 outside_35 + 0.595 outside_36

General Linear Model: near aloe1 versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	0.5548	0.2774	1.05	0.381
Error	12	3.1786	0.2649		
Total	14	3.7333			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.514666	14.86%	0.67%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	38.512	0.138	279.98	0.000	
outside					
34	-0.012	0.202	-0.06	0.954	1.24
35	-0.226	0.178	-1.27	0.227	1.24

Regression Equation

near aloe1 = 38.512 - 0.012 outside_34 - 0.226 outside_35 + 0.238 outside_36

Autocorrelation Function: east

Autocorrelations

Lag	ACF	T	LBQ
1	-0.700775	-2.71	8.94
2	0.563566	1.55	15.17
3	-0.532558	-1.27	21.20
4	0.475969	1.03	26.45

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Response Table for Signal to Noise Ratios

Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
2	41.14	41.00	41.02	40.94	41.17
3	40.79	40.84	40.95		40.95
4			41.13		
Delta	0.35	0.34	0.17	0.13	0.67
Rank	2	3	4	5	1

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Predicted values

* NOTE * Design is not orthogonal.

Prediction

S/N Ratio	Mean	StDev	Ln(StDev)
33.7348	40.5455	0.835915	-0.181412

Settings

outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Predicted values

* NOTE * Design is not orthogonal.

Prediction

S/N Ratio	Mean	StDev	Ln(StDev)
33.7348	40.5455	0.835915	-0.181412

Settings

outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38

Probability Plot of east, north

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 39, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 40, south = 42) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 41, south = 40) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 41, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 39, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 40, south = 42) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 41, south = 41) must be greater than or equal to the number of estimated distribution parameters.

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Linear Model Analysis: SN ratios versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for SN ratios

Term	Coef	SE Coef	T	P
Constant	30.7384	1.6450	18.686	0.000
outside 34	2.4240	2.0796	1.166	0.328
outside 35	-2.1833	1.2752	-1.712	0.185
near alo 33	0.2436	1.7278	0.141	0.897
near alo 34	2.0028	1.7959	1.115	0.346
near cac 32	2.4000	2.6834	0.894	0.437
near cac 33	1.1570	1.8901	0.612	0.584
near cac 34	-1.1606	2.2719	-0.511	0.645
near alo 38	-0.4522	0.8830	-0.512	0.644

near cac 38	-1.6192	3.7096	-0.436	0.692
near cac 39	-0.6041	2.5969	-0.233	0.831

Model Summary

S	R-Sq	R-Sq(adj)
2.2974	68.63%	0.00%

Analysis of Variance for SN ratios

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	23.4900	15.602	7.801	1.48	0.357
near aloe	2	1.6903	6.590	3.295	0.62	0.593
near cactus	3	3.2046	5.427	1.809	0.34	0.799
near aloe1	1	0.0817	1.384	1.384	0.26	0.644
near cactus1	2	6.1690	6.169	3.085	0.58	0.610
Residual Error	3	15.8336	15.834	5.278		
Total	13	50.4692				

Unusual Observations for SN ratios

Observation	SN ratios	Fit	SE Fit	Residual	St Resid	
2	29.245	29.245	2.297	0.000	*	X
5	30.142	30.142	2.297	0.000	*	X
12	34.017	34.017	2.297	-0.000	*	X
14	32.149	32.149	2.297	0.000	*	X

X denotes an observation whose X value gives it large leverage.

Linear Model Analysis: Means versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for Means

Term	Coef	SE Coef	T	P
Constant	40.7880	0.2383	171.180	0.000
outside 34	0.0781	0.3012	0.259	0.812
outside 35	0.1392	0.1847	0.754	0.506
near alo 33	0.1174	0.2503	0.469	0.671
near alo 34	-0.0104	0.2601	-0.040	0.971
near cac 32	0.2844	0.3887	0.732	0.517
near cac 33	-0.0266	0.2738	-0.097	0.929
near cac 34	-0.2667	0.3291	-0.810	0.477
near alo 38	-0.0895	0.1279	-0.700	0.535
near cac 38	-0.6330	0.5373	-1.178	0.324
near cac 39	0.2604	0.3762	0.692	0.539

Model Summary

S	R-Sq	R-Sq(adj)
0.3328	70.85%	0.00%

Analysis of Variance for Means

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	0.28757	0.15341	0.07670	0.69	0.566
near aloe	2	0.07586	0.02628	0.01314	0.12	0.892
near cactus	3	0.23883	0.11215	0.03738	0.34	0.802
near aloe1	1	0.03025	0.05421	0.05421	0.49	0.535
near cactus1	2	0.17479	0.17479	0.08740	0.79	0.530
Residual Error	3	0.33221	0.33221	0.11074		
Total	13	1.13951				

Unusual Observations for Means

Observation	Means	Fit	SE Fit	Residual	St Resid	
2	41.000	41.000	0.333	0.000	*	X
5	41.500	41.500	0.333	0.000	*	X
12	41.000	41.000	0.333	0.000	*	X
14	40.500	40.500	0.333	0.000	*	X

Linear Model Analysis: StDevs versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for StDevs

Term	Coef	SE Coef	T	P
Constant	1.21971	0.2211	5.518	0.012
outside 34	-0.32003	0.2795	-1.145	0.335
outside 35	0.28988	0.1714	1.692	0.189
near alo 33	-0.00162	0.2322	-0.007	0.995
near alo 34	-0.25889	0.2413	-1.073	0.362
near cac 32	-0.32876	0.3606	-0.912	0.429
near cac 33	-0.15486	0.2540	-0.610	0.585
near cac 34	0.14977	0.3053	0.491	0.657
near alo 38	0.04902	0.1187	0.413	0.707
near cac 38	0.21759	0.4985	0.437	0.692
near cac 39	0.06276	0.3490	0.180	0.869

Model Summary

S	R-Sq	R-Sq(adj)
0.3087	67.06%	0.00%

Analysis of Variance for StDevs

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	0.413907	0.27481	0.13740	1.44	0.364
near aloe	2	0.017237	0.11346	0.05673	0.60	0.606
near cactus	3	0.055201	0.10046	0.03349	0.35	0.793
near aloe1	1	0.000281	0.01627	0.01627	0.17	0.707
near cactus1	2	0.095332	0.09533	0.04767	0.50	0.649
Residual Error	3	0.285918	0.28592	0.09531		
Total	13	0.867875				

Unusual Observations for StDevs

Observation	StDevs	Fit	SE Fit	Residual	St Resid	
2	1.414	1.414	0.309	-0.000	*	X
5	1.291	1.291	0.309	-0.000	*	X
12	0.816	0.816	0.309	0.000	*	X
14	1.000	1.000	0.309	0.000	*	X

Response Table for Signal to Noise Ratios

Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near	near	near

			cactus	aloe1	cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
2	41.14	41.00	41.02	40.94	41.17
3	40.79	40.84	40.95		40.95
4			41.13		
Delta	0.35	0.34	0.17	0.13	0.67
Rank	2	3	4	5	1

Response Table for Standard Deviations

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	0.9728	1.2497	1.1455	1.1983	1.0000
2	1.3227	1.1129	1.2217	1.0877	1.2421
3	0.9872	1.1090	1.1275		1.0942
4			1.0374		
Delta	0.3499	0.1407	0.1843	0.1106	0.2421
Rank	1	4	3	5	2

Probability Plot of east
Probability Plot of west
Probability Plot of north
Probability Plot of south
Stability Worksheet
Summary

Testing times: 9 Batches: 3

Samples per batch at each time: 1 Total runs: 27

Main Effects Plot for near aloe

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Linear Model Analysis: SN ratios versus outside, near aloe, near cactus, near aloe1, near cactus1

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Source	DF	Seq SS	Adj SS	Adj MS	F	P
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near aloe1	1	0.000281	0.01627	0.01627	0.17	0.707
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Residual Error	3	0.285918	0.28592	0.09531		
Total	13	0.867875				

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Observation	StDevs	Fit	SE Fit	Residual	St Resid	
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5	1.291	1.291	0.309	-0.000	*	X
12	0.816	0.816	0.309	0.000	*	X
14	1.000	1.000	0.309	0.000	*	X

Response Table for Signal to Noise Ratios

Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
2	41.14	41.00	41.02	40.94	41.17
3	40.79	40.84	40.95		40.95
4			41.13		
Delta	0.35	0.34	0.17	0.13	0.67
Rank	2	3	4	5	1

Response Table for Standard Deviations

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	0.9728	1.2497	1.1455	1.1983	1.0000
2	1.3227	1.1129	1.2217	1.0877	1.2421
3	0.9872	1.1090	1.1275		1.0942
4			1.0374		
Delta	0.3499	0.1407	0.1843	0.1106	0.2421
Rank	1	4	3	5	2

Main Effects Plot for Means

Main Effects Plot for SN ratios

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Predicted values

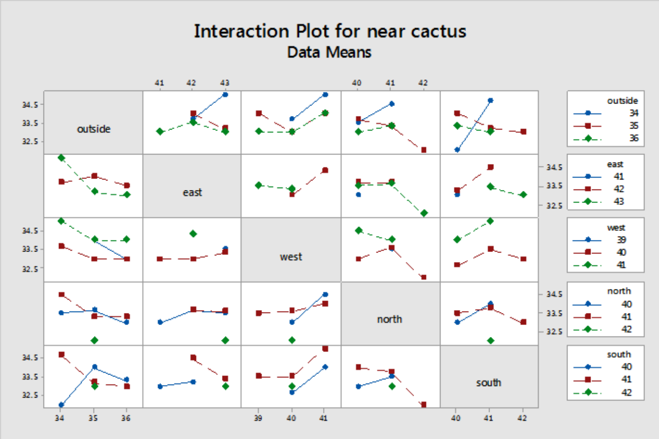
* NOTE * Design is not orthogonal.

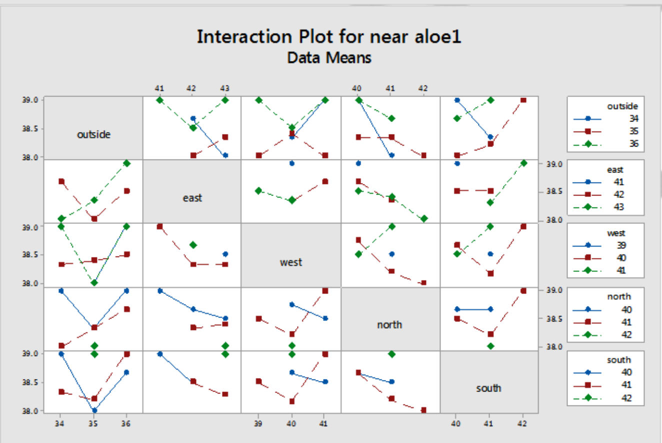
Prediction

S/N Ratio	Mean	StDev	Ln(StDev)
33.7348	40.5455	0.835915	-0.181412

Settings

outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38





Pareto Chart of outside by near aloe

Nested ANOVA: near cactus, near cactus1, near aloe, near aloe1

Nested ANOVA: near cactus versus outside

Analysis of Variance for near cactus

Source	DF	SS	MS
outside	2	1.5548	0.7774
Error	12	10.1786	0.8482
Total	14	11.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	-0.015*	0.00	0.000
Error	0.848	100.00	0.921
Total	0.848		0.921

* Value is negative, and is estimated by zero.

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near cactus1 versus outside

Analysis of Variance for near cactus1

Source	DF	SS	MS
outside	2	2.0190	1.0095
Error	12	3.7143	0.3095
Total	14	5.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.146	32.03	0.382
Error	0.310	67.97	0.556
Total	0.455		0.675

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near aloe versus outside

Analysis of Variance for near aloe

Source	DF	SS	MS
outside	2	2.7548	1.3774
Error	12	6.1786	0.5149
Total	14	8.9333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.180	25.87	0.424
Error	0.515	74.13	0.718
Total	0.695		0.833

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near aloe1 versus outside

Analysis of Variance for near aloe1

Source	DF	SS	MS
outside	2	0.5548	0.2774
Error	12	3.1786	0.2649
Total	14	3.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.003	0.97	0.051

Error	0.265	99.03	0.515
Total	0.267		0.517

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

General Linear Model: near cactus versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	1.555	0.7774	0.92	0.426
Error	12	10.179	0.8482		
Total	14	11.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.920985	13.25%	0.00%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	33.512	0.246	136.15	0.000	
outside					
34	0.488	0.362	1.35	0.203	1.24
35	-0.226	0.318	-0.71	0.490	1.24

Regression Equation

near cactus = 33.512 + 0.488 outside_34 - 0.226 outside_35 - 0.262 outside_36

Fits and Diagnostics for Unusual Observations

Obs	near cactus	Fit	Resid	Std Resid	
14	32.000	34.000	-2.000	-2.51	R

R Large residual

General Linear Model: near cactus1 versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.019	1.0095	3.26	0.074
Error	12	3.714	0.3095		
Total	14	5.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.556349	35.22%	24.42%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	39.476	0.149	265.49	0.000	
outside					
34	-0.476	0.219	-2.18	0.050	1.24
35	-0.048	0.192	-0.25	0.808	1.24

Regression Equation

near cactus1 = 39.476 - 0.476 outside_34 - 0.048 outside_35 + 0.524 outside_36

Fits and Diagnostics for Unusual Observations

Obs	near cactus1	Fit	Resid	Std Resid	
12	40.000	39.000	1.000	2.08	R
14	38.000	39.000	-1.000	-2.08	R

R Large residual

General Linear Model: near aloe versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.755	1.3774	2.68	0.109
Error	12	6.179	0.5149		
Total	14	8.933			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.717552	30.84%	19.31%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	34.155	0.192	178.10	0.000	
outside					
34	-0.155	0.282	-0.55	0.594	1.24
35	-0.440	0.248	-1.78	0.101	1.24

Regression Equation

near aloe = 34.155 - 0.155 outside_34 - 0.440 outside_35 + 0.595 outside_36

General Linear Model: near aloe1 versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	0.5548	0.2774	1.05	0.381
Error	12	3.1786	0.2649		
Total	14	3.7333			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.514666	14.86%	0.67%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	38.512	0.138	279.98	0.000	
outside					
34	-0.012	0.202	-0.06	0.954	1.24
35	-0.226	0.178	-1.27	0.227	1.24

Regression Equation

near aloe1 = 38.512 - 0.012 outside_34 - 0.226 outside_35 + 0.238 outside_36

Autocorrelation Function: east
Autocorrelations

Lag	ACF	T	LBQ
1	-0.700775	-2.71	8.94
2	0.563566	1.55	15.17
3	-0.532558	-1.27	21.20
4	0.475969	1.03	26.45

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* NOTE * Design is not orthogonal.

Response Table for Signal to Noise Ratios
Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
2	41.14	41.00	41.02	40.94	41.17
3	40.79	40.84	40.95		40.95
4			41.13		
Delta	0.35	0.34	0.17	0.13	0.67
Rank	2	3	4	5	1

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Predicted values

* NOTE * Design is not orthogonal.

Prediction

S/N Ratio	Mean	StDev	Ln(StDev)
33.7348	40.5455	0.835915	-0.181412

Settings

outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

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Prediction

S/N Ratio	Mean	StDev	Ln(StDev)
33.7348	40.5455	0.835915	-0.181412

Settings

outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38

Probability Plot of east, north

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 39, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 40, south = 42) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 41, south = 40) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in east (for west = 41, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 39, south = 41) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 40, south = 42) must be greater than or equal to the number of estimated distribution parameters.

* NOTE * Distribution could not be fit. The number of distinct rows of data in north (for west = 41, south = 41) must be greater than or equal to the number of estimated distribution parameters.

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Linear Model Analysis: SN ratios versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for SN ratios

Term	Coef	SE Coef	T	P
Constant	30.7384	1.6450	18.686	0.000
outside 34	2.4240	2.0796	1.166	0.328
outside 35	-2.1833	1.2752	-1.712	0.185
near alo 33	0.2436	1.7278	0.141	0.897
near alo 34	2.0028	1.7959	1.115	0.346
near cac 32	2.4000	2.6834	0.894	0.437
near cac 33	1.1570	1.8901	0.612	0.584
near cac 34	-1.1606	2.2719	-0.511	0.645
near alo 38	-0.4522	0.8830	-0.512	0.644
near cac 38	-1.6192	3.7096	-0.436	0.692
near cac 39	-0.6041	2.5969	-0.233	0.831

Model Summary

S	R-Sq	R-Sq(adj)
2.2974	68.63%	0.00%

Analysis of Variance for SN ratios

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	23.4900	15.602	7.801	1.48	0.357
near aloe	2	1.6903	6.590	3.295	0.62	0.593
near cactus	3	3.2046	5.427	1.809	0.34	0.799
near aloe1	1	0.0817	1.384	1.384	0.26	0.644
near cactus1	2	6.1690	6.169	3.085	0.58	0.610
Residual Error	3	15.8336	15.834	5.278		
Total	13	50.4692				

Unusual Observations for SN ratios

Observation	SN ratios	Fit	SE Fit	Residual	St Resid	
2	29.245	29.245	2.297	0.000	*	X
5	30.142	30.142	2.297	0.000	*	X
12	34.017	34.017	2.297	-0.000	*	X
14	32.149	32.149	2.297	0.000	*	X

X denotes an observation whose X value gives it large leverage.

Linear Model Analysis: Means versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for Means

Term	Coef	SE Coef	T	P
Constant	40.7880	0.2383	171.180	0.000
outside 34	0.0781	0.3012	0.259	0.812
outside 35	0.1392	0.1847	0.754	0.506
near alo 33	0.1174	0.2503	0.469	0.671
near alo 34	-0.0104	0.2601	-0.040	0.971
near cac 32	0.2844	0.3887	0.732	0.517
near cac 33	-0.0266	0.2738	-0.097	0.929
near cac 34	-0.2667	0.3291	-0.810	0.477
near alo 38	-0.0895	0.1279	-0.700	0.535
near cac 38	-0.6330	0.5373	-1.178	0.324
near cac 39	0.2604	0.3762	0.692	0.539

Model Summary

S	R-Sq	R-Sq(adj)
0.3328	70.85%	0.00%

Analysis of Variance for Means

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	0.28757	0.15341	0.07670	0.69	0.566
near aloe	2	0.07586	0.02628	0.01314	0.12	0.892
near cactus	3	0.23883	0.11215	0.03738	0.34	0.802
near aloe1	1	0.03025	0.05421	0.05421	0.49	0.535
near cactus1	2	0.17479	0.17479	0.08740	0.79	0.530
Residual Error	3	0.33221	0.33221	0.11074		
Total	13	1.13951				

Unusual Observations for Means

Observation	Means	Fit	SE Fit	Residual	St Resid	
2	41.000	41.000	0.333	0.000	*	X
5	41.500	41.500	0.333	0.000	*	X
12	41.000	41.000	0.333	0.000	*	X
14	40.500	40.500	0.333	0.000	*	X

Linear Model Analysis: StDevs versus outside, near aloe, near cactus, near aloe1, near cactus1

Estimated Model Coefficients for StDevs

Term	Coef	SE Coef	T	P
Constant	1.21971	0.2211	5.518	0.012
outside 34	-0.32003	0.2795	-1.145	0.335
outside 35	0.28988	0.1714	1.692	0.189
near alo 33	-0.00162	0.2322	-0.007	0.995
near alo 34	-0.25889	0.2413	-1.073	0.362
near cac 32	-0.32876	0.3606	-0.912	0.429
near cac 33	-0.15486	0.2540	-0.610	0.585
near cac 34	0.14977	0.3053	0.491	0.657
near alo 38	0.04902	0.1187	0.413	0.707
near cac 38	0.21759	0.4985	0.437	0.692
near cac 39	0.06276	0.3490	0.180	0.869

Model Summary

S	R-Sq	R-Sq(adj)
0.3087	67.06%	0.00%

Analysis of Variance for StDevs

Source	DF	Seq SS	Adj SS	Adj MS	F	P
outside	2	0.413907	0.27481	0.13740	1.44	0.364
near aloe	2	0.017237	0.11346	0.05673	0.60	0.606
near cactus	3	0.055201	0.10046	0.03349	0.35	0.793
near aloe1	1	0.000281	0.01627	0.01627	0.17	0.707

near cactus1	2	0.095332	0.09533	0.04767	0.50	0.649
Residual Error	3	0.285918	0.28592	0.09531		
Total	13	0.867875				

Unusual Observations for StDevs

Observation	StDevs	Fit	SE Fit	Residual	St Resid	
2	1.414	1.414	0.309	-0.000	*	X
5	1.291	1.291	0.309	-0.000	*	X
12	0.816	0.816	0.309	0.000	*	X
14	1.000	1.000	0.309	0.000	*	X

Response Table for Signal to Noise Ratios
Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
2	41.14	41.00	41.02	40.94	41.17
3	40.79	40.84	40.95		40.95
4			41.13		
Delta	0.35	0.34	0.17	0.13	0.67
Rank	2	3	4	5	1

Response Table for Standard Deviations

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	0.9728	1.2497	1.1455	1.1983	1.0000
2	1.3227	1.1129	1.2217	1.0877	1.2421
3	0.9872	1.1090	1.1275		1.0942
4			1.0374		
Delta	0.3499	0.1407	0.1843	0.1106	0.2421
Rank	1	4	3	5	2

Probability Plot of east
Probability Plot of west
Probability Plot of north
Probability Plot of south
Stability Worksheet
Summary

Testing times: 9 Batches: 3

Samples per batch at each time: 1 Total runs: 27

Main Effects Plot for near aloe

Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1

* NOTE * Design is not orthogonal.

Linear Model Analysis: SN ratios versus outside, near aloe, near cactus, near aloe1, near cactus1

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Term	Coef	SE Coef	T	P
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X denotes an observation whose X value gives it large leverage.

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14	40.500	40.500	0.333	0.000	*	X

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Observation	StDevs	Fit	SE Fit	Residual	St Resid	
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12	0.816	0.816	0.309	0.000	*	X
14	1.000	1.000	0.309	0.000	*	X

Response Table for Signal to Noise Ratios
Nominal is best (10×Log10(Ybar^2/s^2))

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	32.62	30.62	31.15	30.90	32.15
2	29.95	31.57	30.59	31.71	30.55
3	32.43	31.39	31.57		31.72
4			32.16		
Delta	2.67	0.95	1.57	0.81	1.60
Rank	1	4	3	5	2

Response Table for Means

Level	outside	near aloe	near cactus	near aloe1	near cactus1
1	40.94	41.19	41.00	41.06	40.50
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Response Table for Standard Deviations

Level	outside	near aloe	near cactus	near aloe1	near cactus1
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3	0.9872	1.1090	1.1275		1.0942
4			1.0374		
Delta	0.3499	0.1407	0.1843	0.1106	0.2421
Rank	1	4	3	5	2

Main Effects Plot for Means
Main Effects Plot for SN ratios
Taguchi Analysis: east, west, north, south versus outside, ... ar cactus1
* NOTE * Design is not orthogonal.
Predicted values
* NOTE * Design is not orthogonal.
Prediction

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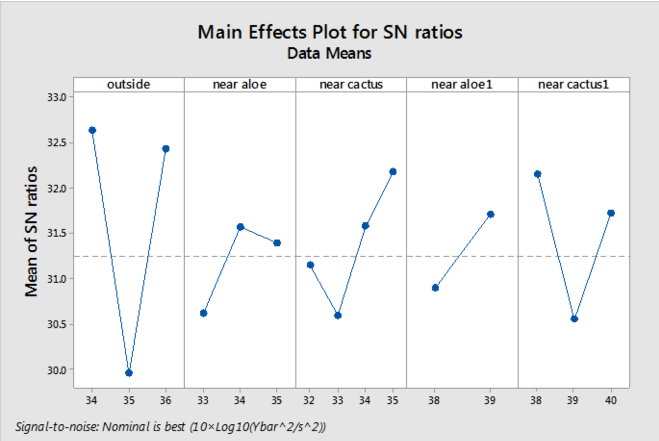
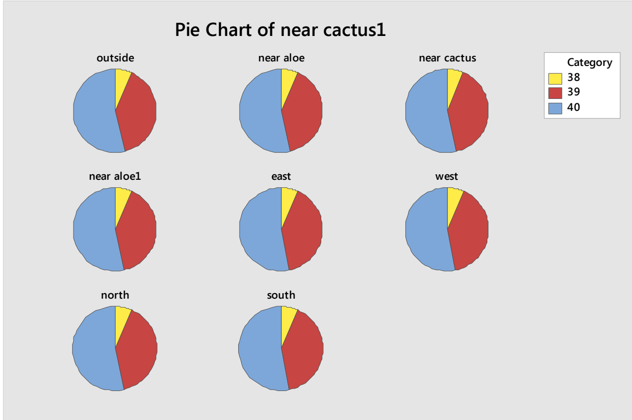
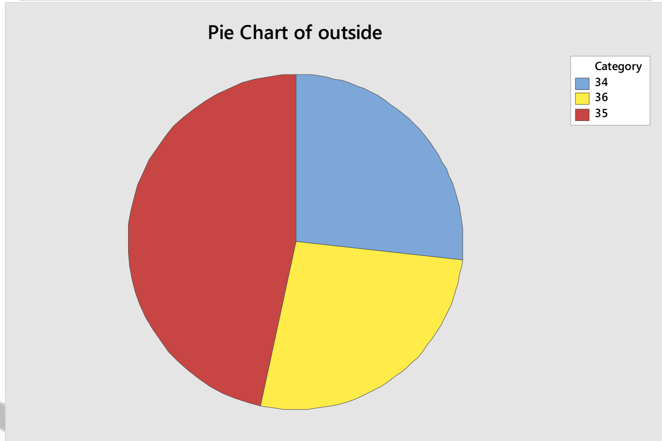
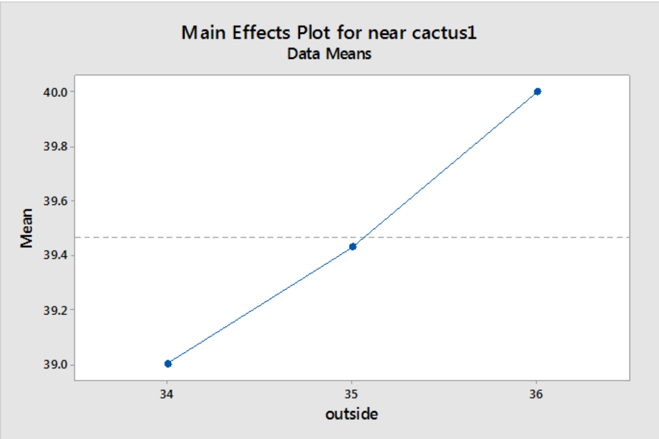
Settings

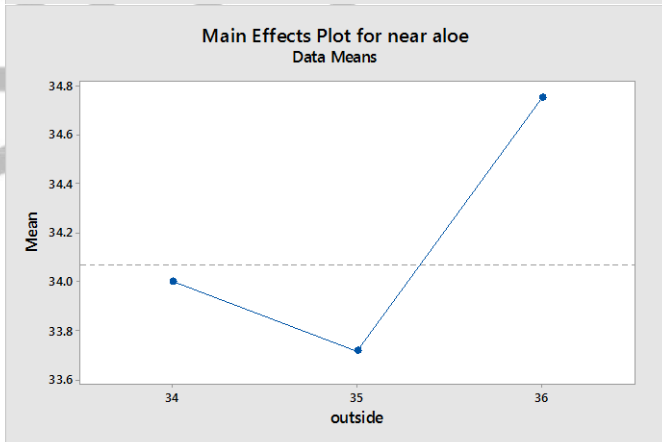
outside	near aloe	near cactus	near aloe1	near cactus1
34	33	32	38	38

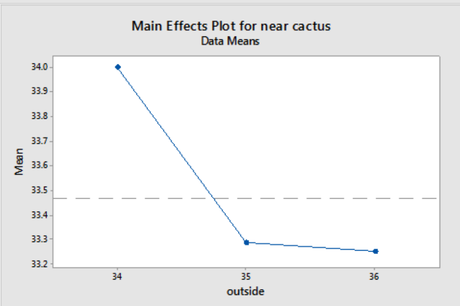


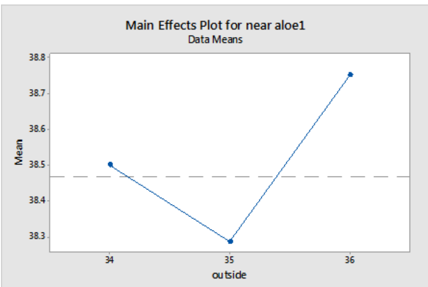


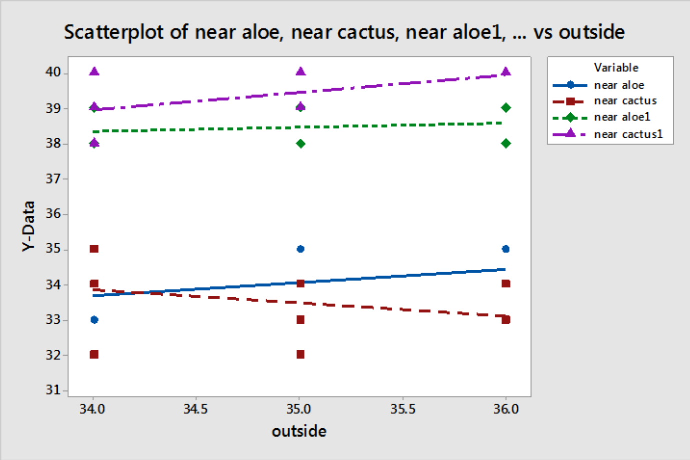


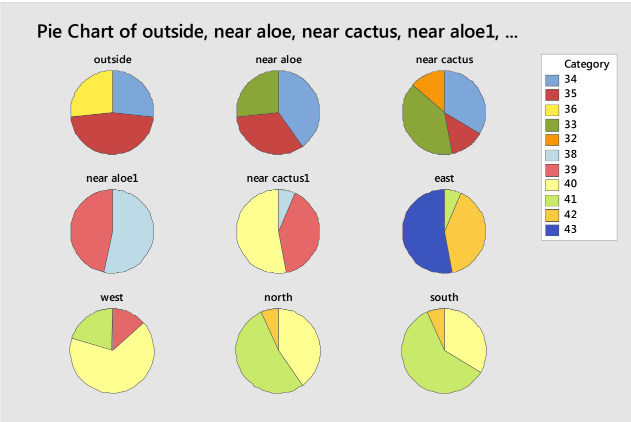












Pareto Chart of outside by near aloe

Nested ANOVA: near cactus, near cactus1, near aloe, near aloe1

Nested ANOVA: near cactus versus outside

Analysis of Variance for near cactus

Source	DF	SS	MS
outside	2	1.5548	0.7774
Error	12	10.1786	0.8482
Total	14	11.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	-0.015*	0.00	0.000
Error	0.848	100.00	0.921
Total	0.848		0.921

** Value is negative, and is estimated by zero.*

Expected Mean Squares

1	outside	1.00(2) + 4.80(1)
2	Error	1.00(2)

Nested ANOVA: near cactus1 versus outside

Analysis of Variance for near cactus1

Source	DF	SS	MS
outside	2	2.0190	1.0095
Error	12	3.7143	0.3095
Total	14	5.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.146	32.03	0.382
Error	0.310	67.97	0.556
Total	0.455		0.675

Expected Mean Squares

1	outside	1.00(2) + 4.80(1)
2	Error	1.00(2)

Nested ANOVA: near aloe versus outside

Analysis of Variance for near aloe

Source	DF	SS	MS
outside	2	2.7548	1.3774
Error	12	6.1786	0.5149
Total	14	8.9333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.180	25.87	0.424
Error	0.515	74.13	0.718
Total	0.695		0.833

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

Nested ANOVA: near aloe1 versus outside
Analysis of Variance for near aloe1

Source	DF	SS	MS
outside	2	0.5548	0.2774
Error	12	3.1786	0.2649
Total	14	3.7333	

Variance Components

Source	Var Comp.	% of Total	StDev
outside	0.003	0.97	0.051
Error	0.265	99.03	0.515
Total	0.267		0.517

Expected Mean Squares

1 outside 1.00(2) + 4.80(1)

2 Error 1.00(2)

General Linear Model: near cactus versus outside
Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	1.555	0.7774	0.92	0.426
Error	12	10.179	0.8482		
Total	14	11.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.920985	13.25%	0.00%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	33.512	0.246	136.15	0.000	
outside					
34	0.488	0.362	1.35	0.203	1.24
35	-0.226	0.318	-0.71	0.490	1.24

Regression Equation

near cactus = 33.512 + 0.488 outside_34 - 0.226 outside_35 - 0.262

Fits and Diagnostics for Unusual Observations

Obs	near cactus	Fit	Resid	Std Resid	
14	32.000	34.000	-2.000	-2.51	R

R Large residual

General Linear Model: near cactus1 versus outside
Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.019	1.0095	3.26	0.074
Error	12	3.714	0.3095		
Total	14	5.733			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.556349	35.22%	24.42%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	39.476	0.149	265.49	0.000	
outside					
34	-0.476	0.219	-2.18	0.050	1.24
35	-0.048	0.192	-0.25	0.808	1.24

Regression Equation

near cactus1 = 39.476 - 0.476 outside_34 - 0.048 outside_35 +

Fits and Diagnostics for Unusual Observations

Obs	near cactus1	Fit	Resid	Std Resid	
12	40.000	39.000	1.000	2.08	R
14	38.000	39.000	-1.000	-2.08	R

R Large residual

General Linear Model: near aloe versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	2.755	1.3774	2.68	0.109
Error	12	6.179	0.5149		
Total	14	8.933			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.717552	30.84%	19.31%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	34.155	0.192	178.10	0.000	
outside					
34	-0.155	0.282	-0.55	0.594	1.24
35	-0.440	0.248	-1.78	0.101	1.24

Regression Equation

near aloe = 34.155 - 0.155 outside_34 - 0.440 outside_35 + 0.595 ou

General Linear Model: near aloe1 versus outside

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
outside	Fixed	3	34, 35, 36

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
outside	2	0.5548	0.2774	1.05	0.381
Error	12	3.1786	0.2649		
Total	14	3.7333			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.514666	14.86%	0.67%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	38.512	0.138	279.98	0.000	
outside					
34	-0.012	0.202	-0.06	0.954	1.24
35	-0.226	0.178	-1.27	0.227	1.24

Regression Equation

near aloe1 = 38.512 - 0.012 outside_34 - 0.226 outside_35 + 0

Item Analysis of outside, near aloe, near aloe1, near ... s, near cactus1

Correlation Matrix

	outside	near aloe	near aloe1	near cactus
near aloe	0.355			
near aloe1	0.183	0.612		
near cactus	-0.310	-0.241	-0.040	
near cactus1	0.591	0.075	-0.058	0.211

Cell Contents
Pearson correlation

Item and Total Statistics

Variable	Total Count	Mean	StDev
outside	15	35.00	0.76
near aloe	15	34.07	0.80
near aloe1	15	38.47	0.52
near cactus	15	33.47	0.92
near cactus1	15	39.47	0.64
Total	15	180.47	1.96

Cronbach's Alpha

Alpha
0.3629

Omitted Item Statistics

Omitted Variable	Adj. Total Mean	Adj. Total StDev	Item-Adj. Total Corr	Squared Multiple Corr	Cronb
outside	145.467	1.598	0.2957	0.5970	0
near aloe	146.400	1.595	0.2579	0.4581	0
near aloe1	142.000	1.732	0.3194	0.4185	0
near cactus	147.000	1.890	-0.1651	0.3724	0
near cactus1	141.000	1.604	0.4176	0.5524	0

Interaction Plot for near aloe
Johnson Transformation for outside, near aloe, near ... st, north, south
Pie Chart of outside, near aloe, near cactus, near aloe1, ...
Pie Chart of outside, near aloe, near cactus, near aloe1, ...
Scatterplot of near aloe vs outside
Scatterplot of near aloe vs outside
Scatterplot of near cactus vs outside
Scatterplot of near cactus vs outside
Scatterplot of near aloe1 vs outside
Scatterplot of near aloe1 vs outside
Scatterplot of near cactus1 vs outside
Scatterplot of near cactus1 vs outside
Chart of east, north, south, west

Trend Analysis for east

Method

Model type	Quadratic Trend Model
Data	east
Length	15
NMissing	0

Fitted Trend Equation

Yt = 42.705 - 0.091×t + 0.0059×t^2

Accuracy Measures

MAPE	1.33239
MAD	0.56396
MSD	0.37242

Trend Analysis Plot for east
Trend Analysis for south
Method

Model type	Linear Trend Model
Data	south
Length	15
NMissing	0

Fitted Trend Equation

$Yt = 40.448 + 0.0357 \times t$

Accuracy Measures

MAPE	1.12051
MAD	0.45556
MSD	0.30508

Single Exponential Smoothing for east
Method

Data	east
Length	15

Smoothing Constant

α 0.0783544

Accuracy Measures

MAPE	1.40720
MAD	0.59686
MSD	0.42412

Symmetry Plot for east
Mixed Effects Model: east versus outside, near aloe, near ... ear cactus
Method

Variance estimation	Restricted maximum likelihood
DF for fixed effects	Kenward-Roger

Factor Information

Factor	Type	Levels	Values
outside	Random	3	34, 35, 36
near aloe	Fixed	3	33, 34, 35
near aloe1	Fixed	2	38, 39
near cactus1	Fixed	3	38, 39, 40
near cactus	Fixed	4	32, 33, 34, 35

Variance Components

Source	Var	% of Total	SE Var	Z-Value	P-Value
outside	0.000000	0.00%	*	*	*
Error	0.628788	100.00%	0.363031	1.732051	0.042
Total	0.628788				

-2 Log likelihood = 27.967311

Tests of Fixed Effects

Term	DF Num	DF Den	F-Value	P-Value
near aloe	2.00	6.00	0.12	0.891
near aloe1	1.00	6.00	0.10	0.767
near cactus1	2.00	6.00	0.53	0.614
near cactus	3.00	6.00	0.12	0.942

Model Summary

S	R-sq	R-sq(adj)
0.792961	34.20%	0.00%

Coefficients

Term	Coef	SE Coef	DF	T-Value	P-Value

Constant	42.318182	0.379863	6.00	111.403876	0.
near aloe					
33	0.000000	0.560708	6.00	0.000000	1.
34	-0.272727	0.593719	6.00	-0.459354	0.
near aloe1					
38	0.090909	0.292820	6.00	0.310460	0.7
near cactus1					
38	-0.386364	0.934939	6.00	-0.413250	0.
39	0.704545	0.773191	6.00	0.911217	0.
near cactus					
32	-0.113636	0.778181	6.00	-0.146028	0.
33	0.022727	0.565467	6.00	0.040192	0.
34	0.340909	0.759595	6.00	0.448804	0.

Marginal Fits and Diagnostics for Unusual Observations

Obs	east	Fit	Resid	Std Resid	
2	43.000000	43.000000	0.000000	*	X
5	43.000000	43.000000	-0.000000	-0.000002	X
14	42.000000	42.000000	0.000000	*	X

X Unusual X

Mixed Effects Model: west versus outside, near aloe, ... s1, near cactus

Method

Variance estimation	Restricted maximum likelihood
DF for fixed effects	Kenward-Roger

Factor Information

Factor	Type	Levels	Values
outside	Random	3	34, 35, 36
near aloe	Fixed	3	33, 34, 35
near aloe1	Fixed	2	38, 39
near cactus1	Fixed	3	38, 39, 40
near cactus	Fixed	4	32, 33, 34, 35

Variance Components

Source	Var	% of Total	SE Var	Z-Value	P-Value
outside	0.000000	0.00%	*	*	*
Error	0.393939	100.00%	0.227441	1.732051	0.042
Total	0.393939				

-2 Log likelihood = 25.161729

Tests of Fixed Effects

Term	DF Num	DF Den	F-Value	P-Value
near aloe	2.00	6.00	2.08	0.206
near aloe1	1.00	6.00	0.35	0.578
near cactus1	2.00	6.00	0.67	0.548
near cactus	3.00	6.00	0.42	0.743

Model Summary

S	R-sq	R-sq(adj)
0.627646	52.09%	0.00%

Coefficients

Term	Coef	SE Coef	DF	T-Value	P-Value
Constant	40.106061	0.300669	6.00	133.389204	0.000
near aloe					
33	0.000000	0.443813	6.00	0.000000	1.000

34	0.909091	0.469941	6.00	1.934478	0.
near aloe1					
38	-0.136364	0.231774	6.00	-0.588348	0.5
near cactus1					
38	0.121212	0.740024	6.00	0.163795	0.
39	-0.515152	0.611997	6.00	-0.841754	0.
near cactus					
32	0.545455	0.615947	6.00	0.885555	0.
33	0.090909	0.447579	6.00	0.203113	0.
34	-0.636364	0.601236	6.00	-1.058427	0.

Marginal Fits and Diagnostics for Unusual Observations

Obs	west	Fit	Resid	Std Resid	
2	40.000000	40.000000	-0.000000	*	X
5	40.000000	40.000000	-0.000000	-0.000006	X
14	40.000000	40.000000	0.000000	*	X

X Unusual X

Mixed Effects Model: north versus outside, near aloe, ... 1, near cactus

Method

Variance estimation	Restricted maximum likelihood
DF for fixed effects	Kenward-Roger

Factor Information

Factor	Type	Levels	Values
outside	Random	3	34, 35, 36
near aloe	Fixed	3	33, 34, 35
near aloe1	Fixed	2	38, 39
near cactus1	Fixed	3	38, 39, 40
near cactus	Fixed	4	32, 33, 34, 35

Variance Components

Source	Var	% of Total	SE Var	Z-Value	P-Value
outside	0.000000	0.00%	*	*	*
Error	0.303030	100.00%	0.174955	1.732051	0.042
Total	0.303030				

-2 Log likelihood = 23.587544

Tests of Fixed Effects

Term	DF Num	DF Den	F-Value	P-Value
near aloe	2.00	6.00	0.93	0.446
near aloe1	1.00	6.00	0.05	0.830
near cactus1	2.00	6.00	2.12	0.201
near cactus	3.00	6.00	1.07	0.428

Model Summary

S	R-sq	R-sq(adj)
0.550482	65.91%	20.45%

Coefficients

Term	Coef	SE Coef	DF	T-Value	P-Value
Constant	40.409091	0.263705	6.00	153.236220	0.000
near aloe					
33	0.333333	0.389249	6.00	0.856349	0.425
34	-0.303030	0.412166	6.00	-0.735215	0.490
near aloe1					
38	0.045455	0.203279	6.00	0.223607	0.830

near cactus1					
38	-1.151515	0.649044	6.00	-1.774171	0.
39	0.393939	0.536757	6.00	0.733925	0.
near cactus					
32	0.818182	0.540221	6.00	1.514531	0.
33	-0.363636	0.392553	6.00	-0.926337	0.
34	-0.454545	0.527318	6.00	-0.861994	0.

Marginal Fits and Diagnostics for Unusual Observations

Obs	north	Fit	Resid	Std Resid	
2	40.000000	40.000000	0.000000	*	X
5	42.000000	42.000000	-0.000000	-0.000003	X
14	40.000000	40.000000	0.000000	*	X

X Unusual X

Mixed Effects Model: south versus outside, near aloe, ... 1, near cactus

Method

Variance estimation	Restricted maximum likelihood
DF for fixed effects	Kenward-Roger

Factor Information

Factor	Type	Levels	Values
outside	Random	3	34, 35, 36
near aloe	Fixed	3	33, 34, 35
near aloe1	Fixed	2	38, 39
near cactus1	Fixed	3	38, 39, 40
near cactus	Fixed	4	32, 33, 34, 35

Variance Components

Source	Var	% of Total	SE Var	Z-Value	P-Valu
outside	0.362934	58.11%	0.542839	0.668584	0.252
Error	0.261615	41.89%	0.182010	1.437365	0.075
Total	0.624548				

-2 Log likelihood = 25.026394

Tests of Fixed Effects

Term	DF Num	DF Den	F-Value	P-Value
near aloe	2.00	4.50	0.60	0.585
near aloe1	1.00	4.25	1.47	0.289
near cactus1	2.00	5.04	0.46	0.655
near cactus	3.00	4.77	0.08	0.967

Model Summary

S	R-sq	R-sq(adj)
0.511483	75.17%	42.06%

Coefficients

Term	Coef	SE Coef	DF	T-Value	P-Value
Constant	40.393656	0.528606	2.29	76.415445	0.000
near aloe					
33	0.198785	0.392104	4.49	0.506971	0.636
34	-0.357149	0.403370	4.36	-0.885413	0.422
near aloe1					
38	-0.237545	0.196011	4.25	-1.211897	0.289
near cactus1					
38	-0.846029	0.886003	5.73	-0.954883	
39	0.514358	0.605677	4.90	0.849227	435
near cactus					

32	-0.187871	0.626812	5.13	-0.299724	0.77
33	0.090097	0.437857	4.94	0.205767	0.8
34	-0.107027	0.514490	4.25	-0.208025	0.8

Marginal Fits and Diagnostics for Unusual Observations

Obs	south	Fit	Resid	Std Resid	
2	41.000000	40.681383	0.318617	0.739944	X
5	41.000000	40.681383	0.318617	0.739944	X
14	40.000000	39.755665	0.244335	0.679704	X

X Unusual X

ARIMA Model: east

*** ERROR * Model contains no autoregressive or moving average term**

Trend Analysis for near aloe

Method

Model type	Linear Trend Model
Data	near aloe
Length	15
NMissing	0

Fitted Trend Equation

Yt = 34.410 - 0.0429×t

Accuracy Measures

MAPE	1.84264
MAD	0.62730
MSD	0.56127

Cluster Analysis of Observations: east, west, north, south

Euclidean Distance, Complete Linkage

Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	14	100.000	0.00000	7		15	7
2	13	100.000	0.00000	2		13	2
3	12	100.000	0.00000	3		9	3
4	11	66.667	1.00000	8		14	8
5	10	66.667	1.00000	7		12	7
6	9	66.667	1.00000	4		10	4
7	8	66.667	1.00000	1		6	1
8	7	52.860	1.41421	7		11	7
9	6	52.860	1.41421	5		7	5
10	5	52.860	1.41421	3		5	3
11	4	42.265	1.73205	4		8	4
12	3	42.265	1.73205	1		4	1
13	2	33.333	2.00000	2		3	2
14	1	0.000	3.00000	1		2	1

Final Partition

	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	15	20.9333	1.13600	1.77138

ABRIKOSOV, I. A. 0 1954

References

1.“Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)”	International Commission on Non-ionizing Radiation Protection	0
2.“The Impulse UHF Field in Experimental and Clinical Practice”	ABRIKOSOV, I. A.	1954
“The Action of a Pulsed Electric UHF Field on the Organism”	ABRIKOSOV, I. A.	1955
3.“The role of coherence time in the effect of microwaves on ornithine decarboxylase activity”	Litovitz TA, Krause D, Penafiel M, Elson EC, Mullins JM	1993
4.“Opioid receptor subtypes that mediate a microwave-induced decrease”	inNL, Pal’tsev IuP, Iasnetsov VV	1994
5.Effect of a magnetic field on carboxydismutase”	AKOYUNOGLOU, G.	1964
6.“Mortality of chicken embryos exposed to EMFs from mobile phones”	Youbicier-Simo BJ, Lebecq JC, Bastide M	1998
7.”Micronucleus induction after whole-body microwave irradiation of rats”	Trosic I, Busljeta I, Kasuba V, Rozgaj R	2002
8.Study on health effects of the shortwave transmitter station of Schwarzenburg, Bern, Switzerland”	E.S. Altpeter, T.H. Krebs	1995
9.The microwave syndrome—further aspects of a Spanish study, in: Proceedings of the Third InternationalWorkshop on Bioelectromagnetic Effects of Electromagnetic Fields, Kos, Greece”	G. Oberfeld, et al	2004
10.Electromagnetic absorption in the human head and neck for mobile telephones at 835 and 1900 MHz, IEE Trans”	O.P. Gandhi, G. Lazzi, C.M. Furse	

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n at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

A. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

B. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive.”
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: “Wb/m2” or “webers per square meter,” not “webers/m2.” Spell units when they appear in text: “...a few henries,” not “...a few H.”
- Use a zero before decimal points: “0.25,” not “.25.” Use “cm3,” not “cc.” (*bullet list*)

C. Equations

The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

Number equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in

$$a + b = \gamma \qquad (1)$$

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1),” not “Eq. (1)” or “equation (1),” except at the beginning of a sentence: “Equation (1) is ...”

D. *Some Common Mistakes*

- The word “data” is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o.”
- In American English, commas, semi-/colons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an “inset,” not an “insert.” The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
- Do not use the word “essentially” to mean “approximately” or “effectively.”
- In your paper title, if the words “that uses” can accurately replace the word using, capitalize the “u”; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones “affect” and “effect,” “complement” and “compliment,” “discreet” and “discrete,” “principal” and “principle.”
- Do not confuse “imply” and “infer.”
- The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the “et” in the Latin abbreviation “et al.”
- The abbreviation “i.e.” means “that is,” and the abbreviation “e.g.” means “for example.”

An excellent style manual for science writers is [7].

II. Using the Template

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

A. *Authors and Affiliations*

The template is designed so that author affiliations are not repeated each time for multiple authors of the same affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization). This template was designed for two affiliations.

1) For author/s of only one affiliation (Heading 3): To change the default, adjust the template as follows.

a) Selection (Heading 4): Highlight all author and affiliation lines.

b) Change number of columns: Select the Columns icon from the MS Word Standard toolbar and then select “1 Column” from the selection palette.

c) Deletion: Delete the author and affiliation lines for the second affiliation.

2) For author/s of more than two affiliations: To change the default, adjust the template as follows.

a) Selection: Highlight all author and affiliation lines.

b) Change number of columns: Select the “Columns” icon from the MS Word Standard toolbar and then select “1 Column” from the selection palette.

c) Highlight author and affiliation lines of affiliation 1 and copy this selection.

d) Formatting: Insert one hard return immediately after the last character of the last affiliation line. Then paste down the copy of affiliation 1. Repeat as necessary for each additional affiliation.

e) Reassign number of columns: Place your cursor to the right of the last character of the last affiliation line of an even numbered affiliation (e.g., if there are five affiliations, place your cursor at end of fourth affiliation). Drag the cursor up to highlight all of the above author and affiliation lines. Go to Column icon and select “2 Columns”. If you have an odd number of affiliations, the final affiliation will be centered on the page; all previous will be in two columns.

B. *Identify the Headings*

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include ACKNOWLEDGMENTS and REFERENCES, and for these, the correct style to use is “Heading 5.” Use “figure caption” for your Figure captions, and “table head” for your table title. Run-in heads, such as “Abstract,” will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named "Heading 1," "Heading 2," "Heading 3," and "Heading 4" are prescribed.

C. Figures and Tables

1) Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1," even at the beginning of a sentence.

TABLE I. TABLE STYLES

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
copy	More table copy[a]		

a. Sample of a Table footnote. *(Table footnote)*

b.

Fig. 1. Example of a figure caption. *(figure caption)*

We suggest that you use a text box to insert a graphic (which is ideally a 300 dpi resolution TIFF or EPS file with all fonts embedded) because this method is somewhat more stable than directly inserting a picture.

To have non-visible rules on your frame, use the MSWord "Format" pull-down menu, select Text Box > Colors and Lines to choose No Fill and No Line.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization," or "Magnetization, M," not just "M." If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization (A (m(1)," not just "A/m." Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)," not "Temperature/K."

Acknowledgment (HEADING 5)

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g." Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

References

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.