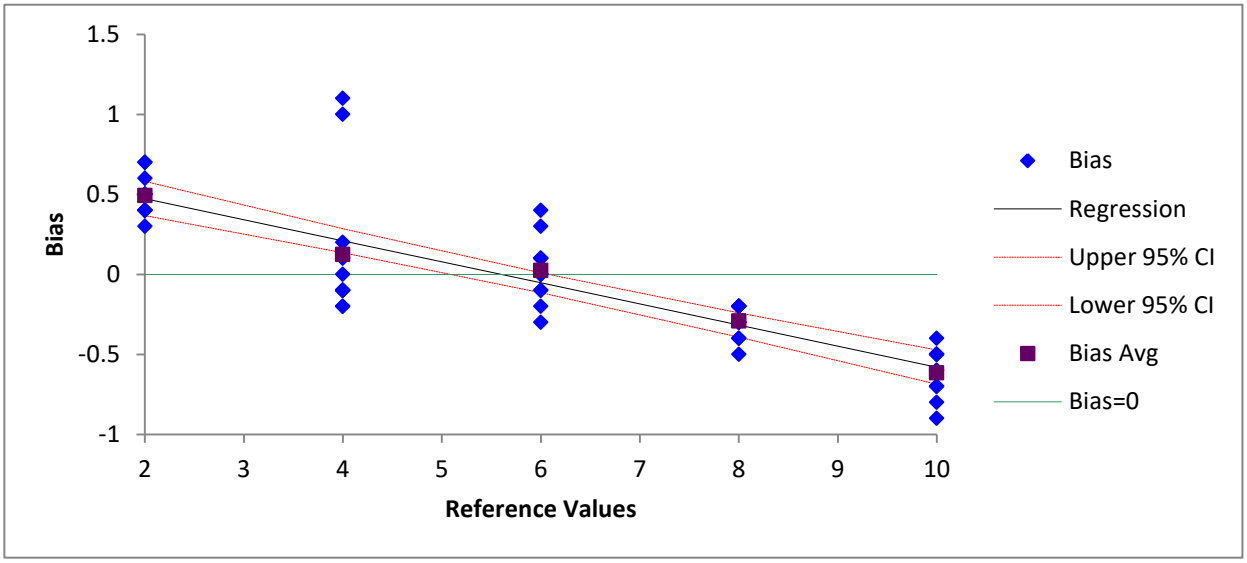
Example: Linearity and Bias Study

Date: 10/5/2018
Gage Name: My Gage
Characteristic: Length
Analysis by: Ton

Operator: Bill
Process Sigma: 2.756
Number of Parts: 5
Maximum Number of Trials: 12

Linearity Chart



This is a plot of bias (operator result - reference value for the part) against the reference value. The best fit line is also shown. If this line is close to horizontal, then the bias does not change across the parts. If the horizontal line is close to 0, then there is no significant bias. If the line is not close to horizontal, the bias may change across the reference values. The regression results below determine this.

Linearity Results

Best Fit Equation: Bias = 0.737 + -0.132(Reference Value)

R Squared = % of variation in bias explained by variation in reference values = 71.43%
s = estimate of standard deviation about the best fit line = 0.240

	Coef.	SE	95% LCL	95% UCL	t	p
Intercept	0.737	0.0725	0.591	0.882	10.16	0.000
Slope	-0.132	0.0109	-0.154	-0.110	-12.04	0.000

Linearity = 6(process sigma)(|slope|)= 2.177
% Linearity = 100(Linearity)/(6*process sigma) = 13.17%

The p-value for the slope is less than 0.05. Linearity is present.
Assess the bias at each reference value below.
Those with p-values < 0.05 have significant bias.

Bias Results

Reference Value	Bias	%Bias	StDev of Mean	t	p
Average	-0.0533	0.32%	0.0308	1.729	0.089
2	0.492	2.97%	0.0358	13.73	0.000
4	0.125	0.76%	0.129	0.968	0.354
6	0.0250	0.15%	0.0566	0.442	0.667
8	-0.292	1.76%	0.0288	10.14	0.000
10	-0.617	3.73%	0.0423	14.56	0.000

The following reference values have significant bias:
2, 8, 10

Data

Run	Part	Reference	Result
1	1	2	2.7
2	1	2	2.5
3	1	2	2.4
4	1	2	2.5
5	1	2	2.7
6	1	2	2.3
7	1	2	2.5
8	1	2	2.5
9	1	2	2.4
10	1	2	2.4
11	1	2	2.6
12	1	2	2.4
13	2	4	5.1
14	2	4	3.9
15	2	4	4.2
16	2	4	5
17	2	4	3.8
18	2	4	3.9
19	2	4	3.9
20	2	4	3.9
21	2	4	3.9
22	2	4	4
23	2	4	4.1
24	2	4	3.8
25	3	6	5.8
26	3	6	5.7
27	3	6	5.9
28	3	6	5.9
29	3	6	6
30	3	6	6.1
31	3	6	6

32	3	6	6.1
33	3	6	6.4
34	3	6	6.3
35	3	6	6
36	3	6	6.1
37	4	8	7.6
38	4	8	7.7
39	4	8	7.8
40	4	8	7.7
41	4	8	7.8
42	4	8	7.8
43	4	8	7.8
44	4	8	7.7
45	4	8	7.8
46	4	8	7.5
47	4	8	7.6
48	4	8	7.7
49	5	10	9.1
50	5	10	9.3
51	5	10	9.5
52	5	10	9.3
53	5	10	9.4
54	5	10	9.5
55	5	10	9.5
56	5	10	9.5
57	5	10	9.6
58	5	10	9.2
59	5	10	9.3
60	5	10	9.4