MSA (Measurement Systems Analysis) 4th Edition Errata Sheet

Analysis of Results – Numerical

5) Compute the average bias of the n readings.

$$avg\ bias = \frac{\sum_{i=1}^{n} bias_i}{n}$$

6) Compute the repeatability standard deviation (see also Gage Study, Range Method, below):

$$\sigma_{repeatability} = \sigma_r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$$

> If a *GRR* study is available (and valid), the repeatability standard deviation calculation should be based on the study results.

7) Determine if the repeatability is acceptable by calculating the

$$\%EV = 100\,[EV/TV] = 100\,[\sigma_{repeatability}/TV]$$

Where the total variation (*TV*) is based on the expected process variation (preferred) or the specification range divided by 6 (see also *GRR* study below).

> If the %*EV* is large (see Chapter II, section D), then the measurement system variation may be unacceptable. Since the bias analysis assumes that the repeatability is acceptable, continuing the analysis with a measurement system with a large %*EV* will lead to misleading and confusing results.

8) Determine the *t* statistic for the bias: [34]

$$\sigma_b = \sigma_r / \sqrt{n}$$

$$t\ statistic = t_{bias} = \frac{average\ bias}{\sigma_b}$$

9) Bias is acceptable (statistically zero) at the α level if

- the p-value associated with t_{bias} is more than α; or

[34] The uncertainty for bias is given by σ_b.