## 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):

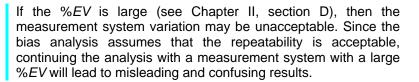
$$\sigma_{repeatability} = \sigma_r = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n-1}$$

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).



8) Determine the t statistic for the bias:  $^{34}$ 

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

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

- 9) Bias is acceptable (statistically zero) at the  $\alpha$  level if
  - the p-value associated with  $t_{bias}$  is more than  $\alpha$ ; or

The uncertainty for bias is given by  $\sigma_b$ .