

A tool to detect sources of variation

Mike's rule to detect sources of variation – The Range/ \bar{x} – Test

The Range/ \bar{x} test is ideal for the evaluation of test methods and/or measuring systems

- An ideal test method would be capable to achieve a Range equal to zero, i.e. the method is 100% repeatable
- One can display this Range in a Range chart, resulting ideally in a flat line; the range-chart would be in control.
- Testing different products/materials with the same ideal test method would therefore deliver values outside the limits; the \bar{x} chart would be “out of control”.

Justification:

- Range is a function of the within subgroup variation, i.e. whatever sample you will measure twice, the ideal method will always deliver zero Range (max-min values).
- \bar{x} is a function of the between subgroup variation and will for sure deliver different values for different samples.
- The \bar{x} control limits are solely a function of the Range (within subgroup variation) and must be therefore identical to the \bar{x} line ($U_{cl}/L_{cl}(\bar{x}) = \bar{\bar{x}} \pm A_2 \text{Range}_{bar}$)

Conclusion:

- The better the test method / measuring system will be, the smaller the within subgroup variation will get.
- The smaller the within subgroup variation will get, the more difficult it will be to keep \bar{x} within control; i.e. \bar{x} out of control will detect real differences between samples, the real variation.

The author does not take any responsibility for contents and correctness.