**SMT-2022-11-0125**

**Point-by-point response to reviewers**

**Reviewer 1**

Comment: The novelty of the article should be more focused. Try to be concise.

Response: There is an increasing number of papers on statistical process monitoring (SPM) methods that containing misleading justifications of the methods they propose. These flawed methods and the incorrect theory associated with them threaten the integrity of the SPM research field. In this paper we aim to demonstrate firstly how large round-off errors – such as those produced by the approaches mentioned above – affect the performance of control charts for means, and secondly how ignoring the round-off errors and using a standard Shewhart chart affects the quality control of a measured process. This study was the basis for a follow-up study in which we suggested a new SPM approach for large rounded data.

We added a paragraph to emphasize the contribution of this study to the relevant literature in the introduction (paragraph 2).

Comment: This articles needs to be re-written because the current version is too vague. The authors must highlight the problem and present their solution.

Response: The article was shortened and rewritten in order to be more focused and less vague.

Comment: Why no real life data example to understand the present methodology is discussed?

Response: We added an example of monitoring a quality characteristic measured with a large round-off error to the introduction (paragraph 9).

Comment: Use consistent notations and symbols.

Response: We went over the manuscript and corrected the inconsistency of some notations and symbols.

**Reviewer 2**

Comment: References need to be updated. There are too many references more than a decade

old. More recent references from the last five years may be included to improve the

literature study.

Response: We added 5 references, 4 from the last 3 years.

Comment: I believe authors should avoid using the terminology used in the statistical inference

such as null hypothesis (𝐻0) and alternative hypothesis (𝐻1). In the SPC context, incontrol

process and out-of-control process can be preferred.

Response: We corrected the terminology accordingly.

Comment: The present study considers the case when the variance of normal distribution is

known which makes this study very limited in actual practice. Authors should provide

some examples of where the variance can be considered to be known.

Response: We added a paragraph addressing this issue to the introduction (paragraph 10).

Comment: It can be provided only one between the models (1) and (2).

Response: We deleted model (1).

Comment: It should be avoided using probability of Type I error. Instead false alarm rate is

more appropriate in the SPC context. Similarly, probability of signal can be used in

place of probability of 1-Type II error. On page 8, “alpha (𝛼)- Type I error-the

probability….” is confusing. 𝛼 is not Type I error. It is the probability of Type I error

(or false alarm rate). Same for beta (𝛽).

Response: We corrected the terminology accordingly.

Comment: Authors frequently use “the process is under control”, for example, on page 8, under

the definition of 𝐴𝑅𝐿0. It should be “the process is in-control”.

Response: We corrected the terminology accordingly.

Comment: In this study, the sample size 𝑛 (sub-group size) is considered mostly large, for

example, 𝑛 = 15, 25, 30, 40. Is there any specific reason to consider a large 𝑛? For

the Shewhart chart when the quality characteristic follows a normal distribution,

𝑛 = 4, 5, 7 is usually considered.

Response: The choice of a relatively large n reflects the fact that crude rounding (δ < 0.5) is the subject of the study. In practice, Y, the rounded value of the normally distributed measurand X, can assume no more than five different values with a significant probability (greater than 0.00001). The other values obtained will have a very small probability and can therefore be disregarded. A small n (e.g. n = 5) might not cover enough possible values of the discreet random variable Y, in which case the control chart of will not reflect the distribution of Y.

We added this explanation at the point in the paper where the n values are mentioned for the first time.

Comment: Authors considered both metrics 𝛼 and 𝐴𝑅𝐿0. However, for Shewhart chart, 𝐴𝑅𝐿0 = 1/𝛼. Therefore, interpretations based on both metrics do not matter. Same is true for 𝐴𝑅𝐿1 and 𝛽 because 𝐴𝑅𝐿1 = 1/(1- 𝛽). I would suggest to use only one between 𝛼 and 𝐴𝑅𝐿0, and 𝐴𝑅𝐿1 and 𝛽.

Response: We decided to use 𝛼 and 𝛽 only.

Comment: On several places, authors claim that the 𝛼 increases implying that the chart’s performance diminishes. It is true. But when the out-of-control performance is evaluated, it is said that for some case, the beta values of rounded data are smaller, therefore, the performance improves. However, it is not clear, whether 𝛼 values for those case increase or decrease.

Response: We agree with this comment. As stated in the abstract of the paper, the results show that given an in-control process, alpha indicates that false alarms are more frequent, whereas given an out-of-control process, the influence on beta is minor and inconsistent. For some rounding levels there is a decline in the control chart performances, and in others there is an improvement.

However, the focus of this study was to demonstrate how ignoring the round-off errors and using a standard Shewhart chart affects the statistical monitoring of a measured process. We wanted to address the irregularity and sometimes counter-intuitive behavior of crudely rounded measurements in the context of using a Shewhart control chart.

There is an increasing number of papers on statistical process monitoring (SPM) methods that contain misleading justifications of the methods they propose. These flawed methods and the incorrect theory associated with them threaten the integrity of the SPM research field. We added a paragraph containing 5 new references to the introduction (paragraph 2) to emphasize the context and the focus of our study. This study was the basis for a follow-up study in which we suggested a new SPM approach for large rounded data.