A COMPARISON OF CONTROL CHARTS FOR VARIABLES CHARACTERISTICS HAVING AN IDEAL VALUE OF ZERO

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Abstract

There are many characteristics for P/M type parts that have an ideal value of zero. Two of these are, for example, concentricity and perpendicularity. If a particular part is "perfect," both of these characteristics will have a value of zero. In reality, it is impossible to produce the "perfect" part, but good parts should have a predominance of the measurements on these characteristics very close to zero, while all will be on the positive side.

Standard SPC charting procedures for these characteristics use $\overline{X}$ and R charts based on samples of three to five items each. The construction of these charts is based on the assumption of a normal distribution of values. In most other applications, the assumption of normality is not critical since the Central Limit Theorem gives approximate normality for the distribution of the sample means from populations that are not radically non-normal.

For characteristics of the type indicated above, the distribution is likely to be quite deviant from a normal. Thus, for the common sample sizes of three and five, the Central Limit Theorem may not be sufficient justification for using $\overline{X}$ charts. This paper considers a probability distribution that is useful for describing variables that can assume only non-negative values. The paper compares charts based on this distribution to the standard $\overline{X}$ chart and also considers the use of attribute charts using examples from a P/M operation.

Introduction

In a powdered metal (P/M) parts manufacturing operation, there are numerous measurable characteristics that require controlling during the production operation. A few of these are overall length (OAL), inside diameter (ID), density and hardness. For these characteristics, it is reasonable to assume that the underlying distribution of values is not radically non-normal and is likely to be at least symmetric. Under these conditions, the Central Limit Theorem can be used to justify the assumption of an underlying distribution for sample means or totals