

Application of Hyperbinomial Distribution in Developing a Modified p-Chart

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Abstract : Control charts graphically verify variation in quality parameters. Attribute type control charts deal with quality parameters that can only hold two states, e.g., good or bad, yes or no, etc. At present, p-control chart is most commonly used to deal with attribute type data. In construction of p-control chart using binomial distribution, the value of proportion non-conforming must be known or estimated from limited sample information. As the probability distribution of fraction non-conforming (p) is considered in hyperbinomial distribution unlike a constant value in case of binomial distribution, it reduces the risk of false detection. In this study, a statistical control chart is proposed based on hyperbinomial distribution when prior estimate of proportion non-conforming is unavailable and is estimated from limited sample information. We developed the control limits of the proposed modified p-chart using the mean and variance of hyperbinomial distribution. The proposed modified p-chart can also utilize additional sample information when they are available. The study also validates the use of modified p-chart by comparing with the result obtained using cumulative distribution function of hyperbinomial distribution. The study clearly indicates that the use of hyperbinomial distribution in construction of p-control chart yields much accurate estimate of quality parameters than using binomial distribution.

Keywords : binomial distribution, control charts, cumulative distribution function, hyper binomial distribution

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