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A Blended Two Sided Chain Sampling Plan Created on Process Potential Measure

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Abstract

This research article presents, a blended two sided chain inspection plan with process potential measure $\hat{C}_m$. The Probability of acceptance and related measures are shown. Tables are prepared to find the parameters of the plan. In this plan the variable inspection sample size is obtained by using normal distribution and in the attribute inspection,two sided chain sampling plan,which yields small sample size is used,The designed sampling plan is really used in production industries to study the product with respect to the specification measures and to defend the period and charge of inspection to impact on the end product.

Keywords: Two sided Chain Sampling, Process potential measure, Manufacturers' and Customer's risks.

Introduction

The acceptance sampling plans are mostly used in many industries and fabrications for controlling the cost of inspection, and helping to declare the quality of the manufactured goods. Process potential measure is an essential tool to monitor the constant progress in quality and efficiency. The variable inspection is done by process potential measure $\hat{C}_m$ based on normal distribution and chi square distribution. The attribute inspection is done by an attribute sampling plan based on Poisson distribution. For practical reason, acceptance number of zero plans is more insisted in the attribute inspection. Therefore two sided chain sampling plan which return small sample size is proposed in the attribute assessment.

Literature Review

A multiple dependent state variable sampling plans with process loss consideration was designed by AslamYen and Chang in the year 2014.In the year 2015, a flexible process-capability-qualified resubmission-allowed acceptance sampling scheme was made by Shu, Nugroho, and Kurniati , A repetitive group sampling plan based on the process capability index for the lot acceptance problem was introduced by Nezhad and Seifi in 2017.Againin 2018 and 2019, Aslam has done a multiple dependent state repetitive sampling plans for one-Sided process capability indices. Deva Arul , Edna and Jemmy designed mixed sampling plans for costly or destructive items in the year 2011 and 2019.

Algorithm of the Independent Blended Sampling Plan (m_1, m_2, K, i**)**

1. Take a random sample of size m_1 from the lot

2. Calculate the process potential measure $\hat{C}_m$

3. If the process potential measure $\hat{C}_m > K$,then admit the entire lot or process.

4. If $\hat{C}_m < K$ then draw a sample of size m_2 for attribute inspection.

5. Examine and count the numeral of imperfects in the attribute inspection sample. If the following conditions are true, then admit the lot.

   (i) Accept the lot, if D (the number of imperfects) is zero in the sample of m_2 items and reject if D > 1.

(ii) Accept the lot, if D= 1 and if no defectives are found in the immediately past 'i'samples and the next 'j' samples of size m_2..

Operating characteristics function:

The operating characteristics function Pa (p) of two sided complete chain sampling plan is

$$P_a(p) = P_{m1}\left(\hat{C}_m \geq K\right) + P_{m2}\left(\hat{C}_m < K\right) e^{-m2p}\{1 + m_2 p e^{-2im_2p}\}$$, if i=j

i=immediately past sample

j=immediately next sample

m=Sample size

p=Fraction defective

Designing and Selection of the Sampling Plan (m_1, m_2, K, i)

2. Let C_{AQL}, C_{LTPD} be potential requirement corresponding to AQL and LTPD. The needed sample size m_1 and critical acceptance constant K of $\hat{C}_m$ are obtained from the following equations,

$$\int_0^{b_1\sqrt{n_1}/(1+3k)} G\left(\frac{(b_1\sqrt{n_1}-t)^2-t^2}{9k^2}\right)\left[\varphi(t+\xi\sqrt{n_1})+\varphi(t-\xi\sqrt{n_1})\right]dt=\beta_1'$$

$$\int_0^{b_2\sqrt{n_1}/(1+3k)} G\left(\frac{(b_2\sqrt{n_1}-t)^2-t^2}{9k^2}\right)\left[\phi(t+\xi\sqrt{n_1})+\phi(t-\xi\sqrt{n_1})\right]dt=\beta_2'$$

Where $b_1 = 3C_{AQL}(1+\xi^2)^{1/2}+|\xi|$

$b_2 = 3C_{LTPD}(1+\xi^2)^{1/2}+|\xi|$

$C_{AQL} > C_{LTPD}$

4. Calculate the attribute inspection sample size n_2 and acceptance number from

$e^{-m_2p}\{1+m_2p\, e^{-2im_2p}\} = \beta_1''$, if i=j ,for p =$p_1$

$e^{-m_2p}\{1+m_2p\, e^{-2im_2p}\} = \beta_2''$, if i=j, for p = p_2

TABLE 1: Values of (m_1, m_2, K, i)given, $(p_1,\beta_1),(p_2,\beta_2)$ and C_{AQL} = 1.33, C_{LTPD} = 1.00 Let $\beta1'$=0 .90, $\beta2'$=0 .90, ξ =.5

p_1	β_1	β_1'	β_1''	p_2	β_2	β_2'	β_2''	n_1	$\hat{C}_m$ (or)K	Values of n_2				
										i= j=1	i=j=2	i=j=3	i=j=4	
.001	.986	.903	.90	.0523	.01	.0252	.0743	102	1.20021	90	67	50	32	
.002	.975	.920	.85	.0621	.10	.0151	.0923	133	1.20353	70	43	38	20	
.003	.968	.903	.75	.0353	.10	.0153	.0922	127	1.21282	62	50	34	18	
.004	.943	.902	.52	.0354	.10	.0152	.0921	120	1.21281	52	45	30	16	
.005	.9655	.902	.75	.0514	.10	.0251	.0739	101	1.20022	38	22	14	6	
.006	.965	.902	.75	.0452	.10	.0153	.0917	128	1.21281	18	10	7	6	
.007	.990	.925	.86	.0523	.10	.0150	.0918	128	1.21283	10	6	4	2	

EXAMPLE: In a company producing of electronic chips, the objective value T is given as .6mm with respect to the thickness of the chips. The USL of chips thickness is .65mm and the LSL is .53mm. C_{AQL} and C_{LTPD} are given as 1.33 and 1.00 respectively. Find the acceptance criterion of the process and product control sampling plan for (p_1,β_1) = (0.003, 0.968), (p_2,β_2) = (0.0353, 0.10) and i=j=3

Solution:

From the table n_1=127,K=1.21282,n_2=34 and i=j=3

Where $\beta_1^{'}$ =0 .90, $\beta_1^{''}$=0.50, $\beta_2^{'}$ =0 .015, $\beta_2^{''}$=0.092 .

If $\hat{C}_m$ > 1.21282, admit the entire lot or process.

If $\hat{C}_m$ < 1.21282 Consider an attribute inspection sample of size m_2=34

(i)Examine and count the number of unacceptable items (D) in the second sample.

(ii) Accept the lot, if D is zero in the sample of m_2 items and reject if D > 1.

(iii)Accept the lot, if D= 1 and if no defectives are found in the immediately past 'i'=3 samples and the next 'j=3' samples of size m_2.

Conclusion

The designed blended two sided chain sampling plan with process potential index $\hat{C}_m$ is really used in production field to monitor the product with respect to the specified limits. This kind of potential measure is used to reduce the inconsistency in the product.. Since the plan is designed based on the past and the future results, and the obtained attribute inspection sample size is small, it defends the period and charge of inspection to impact on the end product.

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