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OISM 470

Section 4

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Taguchi & Quality Loss Function

Topics Covered

Dr. Genichi Taguchi

The Taguchi Method

-Quality Loss Function

Dr. Genichi Taguchi

- *Widely acknowledged leader in the U.S. industrial quality movement.*
- *Credited for starting the "Robust Design" movement in Japan in 1950's.*
- *Helped correct postwar Japan's telephone system.*
- *1980 introduced Taguchi method to AT&T.*

The Taguchi method

- *Quality*
- *Robust Design*
- *Quality Loss Function*

Quality

- *Ideal Quality*

*- **reference point (target value)** for determining the quality level of a product or service.*

- delivery of a product or a service that reliably performs it's intended use throughout it's life cycle under reasonable conditions.

Robust Design

- *"An Engineering methodology for improving productivity during research and development so that high-quality products can be produced quickly and at low cost"* (1).
- *Products and services designed defect free and of high quality*
- *A design with minimum sensitivity to variations in uncontrollable factors.*

Quality Loss Function

- ***Defined***

  -economical and societal penalties incurred as a result of purchasing a nonconforming product.

Determining Quality Loss Function

- Specifications are set
- Specify a target with minimal variation
- Increase in variation cause loss to society

Set Specifications

- ***Loss to society***

  -Product rejection

  -Product rework

  -Pollution

Specify a target with *minimal variation*

Specify a target with *minimal variation*

- *Disagreements with standard quality*

Specify a target with *minimal variation*

- *Quadratic Loss Function*

Specify a target with *minimal variation*

- ***Quality Loss Function***

  -economical and societal penalties due to a purchase of a nonconforming product.

- ***QLF computation***:

$K = C/T^2$

K = constant

C = unit repair cost

T = tolerance interval

$L = K*V^2$ ($/unit)

L = penalty incurred by the customer

V = the mean standard deviation

Practice Exercise

- Anna's Bakery had incurred a maintenance cost of $600 on one of their bake ovens that bakes one of their specialty chocolate cakes. What is the QLF for losses incurred as a result of deviation from a target setting where a tolerance of 6 +/- .8mm is required and the mean squared deviation from the target is $(1/6)^2$?

Practice Exercise

- ***Solution***

$$K = C/T^2 = \$600/.8^2 = 937.5$$

$$L = K*V^2 = \$937*(1/6)^2 = \$26.04/\text{unit}$$

Why use Taguichi's Quality Loss Function?

1) To find out how much loss is brought to Society due to a purchase of a nonconforming product.

2) To implement a product design improvement.

How can we use Taguchi's Quality Loss Function in real life?

Let's assume that you are an Operations Manager at a company that produces custom made doors and door frames. During the winter, due to cold weather, doors tend to shrink which lets in cold air through the cracks between the door and the door frame. During the summer doors tend to expand beyond it's normal size due to hot weather, which makes to door hard to open because it rubs against the door frame. Your job is to produce a door, where dimensions (length and width of the door) are set to a specific target level. In other words in the Winter the door cannot let any cold air in the house and it should open properly in the Summer.

How can we use Taguchi's Quality Loss Function in real life?

Success Stories

- *AT&T Bell Laboratories (Computer Response-Time Optimization).*
- *Chrysler Motors Engineering (Sheet-Molded Compound Process Improvement)*

  -finished products improved from 77% to 96%.

  -scrap was reduced from 16% to 1.7%.

Summary

- *Japanese thoughts and traditions influenced Taguchi's methods.*
- *Taguchi Methods is a system of cost-driven quality engineering.*
- *Emphasizes the effective application of engineering strategies.*

Summary

- *Companies design and produce low-cost, highly reliable quality products and processes.*
- *Cuts research, development, and delivery time.*
- *Allows engineers to develop flexible technology for the design and production.*

Summary

- *Quality Loss Function supports Dr. Taguchi's method.*
- *Determine and compare different costs.*
- *Specify changes to implement a product design improvement.*

Bibliography

1) *Wysk, R. A., Niebel, B. W., Cohen, P. H., and Simpson, T. W..* ***Manufacturing Processes: Integrated Product and Process Design****, McGraw Hill, New York, 2000.*

2) *Foster, S. T. .* ***Managing Quality: An Integrated Approach.*** *Upper Saddle River, New Jersey , 2001.*

3) *Chaplin, E., and Terninko, J..* ***Customer Driven Healthcare: QFD for Process Improvement and Cost Reduction****. Milwaukee, Wisconsin, 2000.*