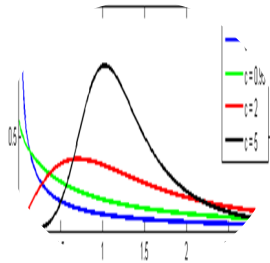


ANALYSIS OF PROCESSES CAPABILITY USING THE SKEWED NORMAL DISTRIBUTION

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Research Practice I
EAFIT University
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PROCESS CAPABILITY INDICES REQUIRES NORMALITY



In practice there are interest variables that do not follow a normal distribution.

$$C_p = \frac{USL - LSL}{6\sigma}$$

Traditional process capability indices are sensitive to non-normality of data.



CONTENT

- Limitations of process capability indices calculation for non-normal processes.
- Level of importance of this research.
- Objectives.
- Activity schedule.

HOW NON-NORMAL PROCESSES ARE MONITORED?

Examination of PCIs and their performances. [1]

Construction of new generation PCIs and development of new approaches.

Data transformation methods.

Development of quality control procedures for certain non-normal distributions.

Distribution fitting for empirical data.

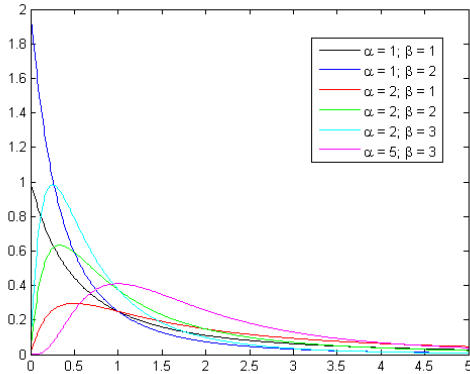
Development of distribution-free procedures.

Construction of new PCIs.

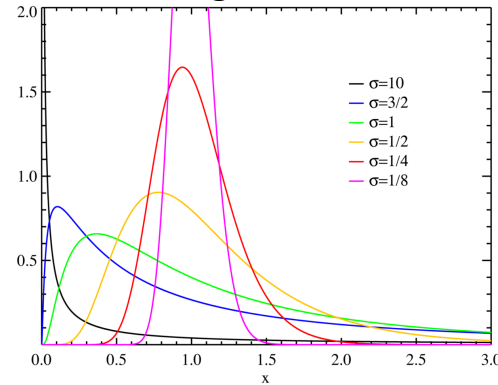
[1] Korkusuz, D. (2011). "Process Capability Analysis for Non-normal Processes with Lower Specification Limits" (Master's Thesis). Chalmers University of Technology.

ONLY POSITIVE ASYMMETRY DISTRIBUTIONS HAVE BEEN USED

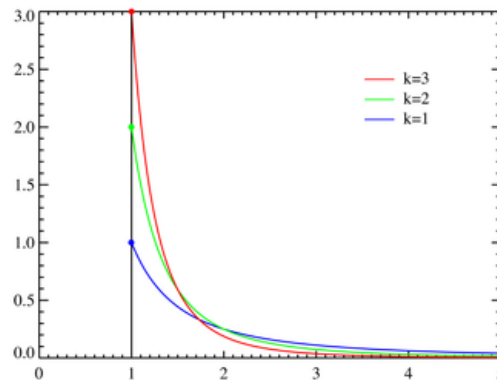
Beta



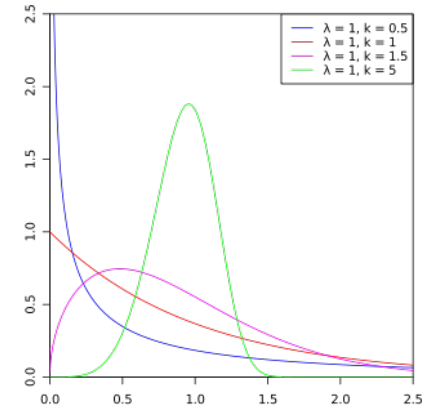
Log-normal



Generalized Pareto



Weibull



The probability density functions were taken from: www.wikipedia.com

SKEWED NORMAL DISTRIBUTION –SND–

The probability density function associated to a random variable with a Skewed Normal distribution is as follows [2]:

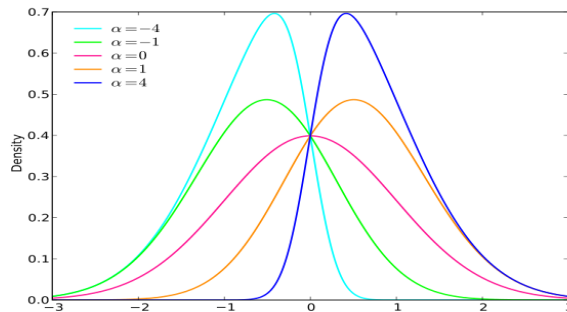
$$f(x) = \frac{1}{\omega\pi} e^{-\frac{(x-\xi)^2}{2\omega^2}} \int_{-\infty}^{\alpha\left(\frac{x-\xi}{\omega}\right)} e^{-\frac{t^2}{2}} dt$$

Where

ξ is a position parameter

ω is a scaling parameter

α is a shape parameter



Taken from: www.wikipedia.com

- $\alpha < 0$ → Positive asymmetry
- $\alpha = 0$ → Symmetry
- $\alpha > 0$ → Negative asymmetry

[2] Figueiredo, F. and Gomes, I. (2011) "The skew-normal distribution in SPC". National Funds through Fundação para a Ciência e a Tecnologia.

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**SND HAS NOT BEEN USED IN THE PROCESS
CAPABILITY INDICES**

[2] Figueiredo, F. and Gomes, I. (2011) "The skew-normal distribution in SPC". National Funds through Fundação para a Ciência e a Tecnologia.

LEVEL OF IMPORTANCE OF THIS RESEARCH

The importance and originality of this research are based on these facts:

1. According to the systematic literature review, there are no proposals for estimating process capability indices under Skewed Normal distribution.
2. The asymmetrical flexibility given by the Skewed Normal distribution will render its worth by giving robust process capability indices and making easier the data fitting.

OBJECTIVES

Main objective:

Develop capability indices for processes with non-normal data using Skewed Normal distribution.

Specific objectives:

- Identify methods to estimate process capability indices associated with non-normal data.
- Select one of these methods and adapt it to the Skewed Normal distribution.
- Develop the proposed methodology in a programming language.
- Compare the proposed methodology performance against conventionally used methods reported in literature.

ACTIVITY SCHEDULE

Activity	Semester Week	Dates
Literature review.	1 – 5	July 21 – August 23
Methods adaptation to the Skewed Normal distribution.	6 – 9	August 24 – September 20
Implementation by means of a programming language.	8 – 11	September 7 – October 4
Selected methods performance comparison against conventionally used methods reported in literature.	12 – 14	October 5 – October 25
Project report.	15 – 16	October 26 – November 8
Project presentation.	17 – 19	November 9 – November 27

**THANKS FOR YOUR
ATTENTION**