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Research paper

Evaluation of NSE Price Data Using Reliability of Series Structure Model

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Abstract

Fluffy set based techniques have been turned out to be successful in taking care of numerous kinds of vulnerabilities in various fields, including dependability building. In any modern system, the reliability and cost are considered to be the most important factor and the reliability of the system may be twisted as linear or nonlinear programming. This paper deals the fluffy nonlinear reliability optimization problem for series structure model. The objective of this paper is to quantify the most extreme unwavering quality subject to leat cost using triangular fluffy number. As an illustration, system of five components NSE price data is analyzed

Keywords: *Fluffy sets, Reliability, Series structure, Triangular fluffy number, Fluffy Non-linear Programming.*

1. Introduction

The Reliability optimization provides help to the reliability engineer to get the finest manner to enhance the reliability of the system. Reliability is a gauge of the result for the quality of the product in the long run. Reliability of product is not identified before the outcome and it is based on its constraints such as cost, weight etc. The constraint of reliability problems can be involved in uncertain factors and it can be represented by fluffy number.
Shi et al [9] presented the reliability performances for a cold standby series structure by using empirical Bayesian and multiple Bayesian methods. Nabil Nahas et al [6] analyzed an application of ant system in reliability for a series structure to maximize the system reliability subject to the system budget. Yuan et al [11] and Benjamin Epstein et al [2] have investigated special techniques and solutions on series structure in different situation.
Abdul Razak at al [1] presented the parallel system model to evaluate the maximum reliability using co-efficient of variance. Ruan & Sun [8] offered a correct method for least cost problem in series reliability system with several element choices. Mahapatra et al [5] presented fluffy reliability problem of series structure model in the course of fluffy parametric geometric programming using max-min and max additive operator.
Sung et al [10] used a reliability optimization problems for a series structure with multiple-choice to most extreme unwavering quality subject to least cost of the system. Ezzatallah et al [3] analyzed reliability of the fluffy system of a series and parallel system, using fluffy confidence interval. Lee et al [4] analyzed the Reliability of a parallel system using (λ,ρ) interval valued fluffy numbers.
This paper isdeveloped as pursues. Segment 2 expresses the documentations and fluffy sciences essentials. The scientific plan in fresh model and fluffy model are examined in segment 3.The mathematical investigation is described in segment 4. The solution process for the series structure models are discussed in segment 5. Segment 6 considers numerical implementation that evaluates the reliability of series structure. Conclusion has been discussed in segment 7.

2. Mathematical model

2.1. Notations

R_i - Reliability of ith component for $i = 1,2,\ldots.m$
C_i - Cost of ith component of reliability for $i = 1,2,.m$
$R_S\,(R_1, R_2, R_3\ldots..R_m)$ - System reliability of m components with reliability R_i, $i = 1,2,\ldots.m$
$C_S\,(R_1, R_2, R_3\ldots..R_m)$ - System cost of m components with reliability R_i, $i = 1,2,\ldots.m$
The reliability for the Series structure is

$$R_S\left(R_1,R_2,R_3\ldots R_m\right)=\prod_{i=1}^{m}R_i$$

The linear cost components are represented by

$$C_S\left(R_1,R_2,R_3\ldots R_m\right)=\sum_{i=1}^{m}c_iR_i\,,c_i\geq 0$$

2.2. Fluffy mathematics prerequisites

A triangular fluffy number $\tilde{A}=(a_1,a_2,a_3)$ is a fluffy set on R with the membership function $\mu_{\tilde{A}}(x):X\to[0,1]$ is defined as

$$\mu_{\tilde{A}}(x)=\begin{cases}\dfrac{x-a_1}{a_2-a_1} & if \quad a_1\leq x\leq a_2\\ \dfrac{a_3-x}{a_3-a_2} & if \quad a_2\leq x\leq a_3\\ 0 & otherwise\end{cases}$$

3. Mathematical formulation

3.1. Crisp model

The series structure model is considered with m components.
To quantify the most extreme of reliability R_S (R_1,R_2, R_3…R_m) subject to least cost C in nonlinear programming problem is

$$\text{Maximize} \quad R_S(R_1,R_2,R_3.....R_m)=\prod_{i=1}^{m} R_i$$

$$\text{Subject to} \quad C_S(R_1,R_2,R_3.....R_m)=\sum_{i=1}^{m} c_i R_i \le C \qquad (1)$$

3.1. Fluffy model

In practice the cost factor plays a key role in reliability analysis and it can be concerned in undecided factors. So the reliability of this structure subject to the fluffy cost is

$$\text{Maximize } R_S(R_1,R_2,R_3...R_m)=\prod_{i=1}^{m} R_i$$

$$\text{Subject to } C_S(R_1,R_2,R_3...R_m)=\sum_{i=1}^{m} \tilde{c}_i R_i \le \tilde{C},\ 0<R_i\le 1 \qquad (2)$$

4. Mathematical analysis

A non-linear programming problem having one inequity constraint is
Maximize Z = f (x_1, x_2…….x_n)
Subject to

$$h(X) \le 0 \text{ where } h(X) = g(x_1, x_2...x_n)\text{-b}, h(X) \ge 0 \qquad (3)$$

By Kuhn-Tucker condition in Premkumar Gupta et al (7), the essential conditions for the maximization of non-linear programming problem is expressed as

$$\frac{\partial f}{\partial x_j} - \lambda \frac{\partial h}{\partial x_j} = 0$$

$$\lambda \text{ h X}) = 0, \text{ where } h(X) \le 0 \text{ and } \lambda \ge 0 \qquad (4)$$

5. Solution procedure for reliability of series structure models

Step 1:Let the cost co-efficient be $\tilde{c}_i = (c_{i1}, c_{i2}, c_{i3})$ for i=1,2…n and the cost constraint be $\tilde{C} = (C_1, C_2, C_3)$ be in use as Triangular fluffy number.

Step 2:Using α-cut membership function , the fluffy cost co-efficient is $\tilde{c}_i = [c_{i1} + \alpha\,(c_{i2} - c_{i1}), c_{i3} - \alpha\,(c_{i3} - c_{i2})]$ and fluffy cost constraint is $\tilde{C} = [C_1 + \alpha(C_2 - C_1), C_3 - \alpha(C_3 - C_2)]$

Step 3: Applying the Kuhn-Tucker condition in a fluffy non-linear programming problem for the series structure model of left and right interval α-cut is expressed as

$$\text{Maximize} \quad R_S^L(R_1^L, R_2^L, R_3^L...R_m^L) = \prod_{i=1}^{m} R_i^L$$

$$\text{Subject to} \quad \sum_{i=1}^{m} \tilde{c}_i^L R_i^L - \tilde{C}^L \le 0\ ,$$

where $0 < R_i^L \le 1,\ \tilde{c}_i^L and\ \tilde{C}^L \ge 0$

$$\text{Maximize} \quad R_S^R(R_1^R, R_2^R, R_3^R....{}_m^R) = \prod_{i=1}^{m} R_i^R$$

$$\text{Subject to} \quad \sum_{i=1}^{m} \tilde{c}_i^R R_i^R - \tilde{C}^R \le 0\ ,$$

where $0 < R_i^R \le 1,\ \tilde{c}_i^R and\ \tilde{C}^R > 0$

Step 4: To find out the optimal solution of R_i^L and R_i^R i =1,2…m and to calculate the system of reliability $R_S^L = \prod_{i=1}^{m} R_i^L$ and $R_S^R = \prod_{i=1}^{m} R_i^R$ for each membership value of α.

Step 5: From the membership value of α to evaluate the maximum reliability.

6. Numerical example

The National Stock Exchange value of ICICI bank is illustrated as an example. The historic Prices of ICICI Bank is downloading from the website:
http://www.moneycontrol.com/stocks/companydetails/histdata.php.
The NSE price data for ICICI bank dated from 06/06/2016 to 10/06/2016 is considered tabulated as

Date	Open Price	High Price	Low Price	Close Price
06-06-2016	243.40	246.00	242.00	253.50
07-06-2016	245.50	254.85	244.70	254.10
08-06-2016	255.20	261.20	252.80	257.65
09-06-2016	257.00	259.25	253.20	254.55
10-06-2016	253.00	257.65	251.50	252.60

This naturally shows that, the five components (date) of series structure and the cost values are uncertain in nature. Let us consider the Low price, Close price and High price value as the cost parameter and it is represented by triangular fluffy number

Step 1: The cost co-efficient is c_1 = (242.0, 253.50, 246.0),
c_2 = (244.70, 254.10, 54.85),
c_3 = (252.80, 257.65, 261.20),
c_4 = (253.20, 254.55, 259.25) and
c_5 = (251.50, 252.60, 257.65).
The cost constraint is
$\tilde{C}$ = (1120.00, 1180.50, 1215.00)

Step 2: Using α-cut membership function the cost co-efficient and constraints of left and right interval value are tabulated as

Cost components	Cost constraints
$c_1 = (c_1^L, c_2^R)$ = (242.00+1.50α, 246.00-2.50α) $c_2 = (c_2^L, c_2^R)$ = (244.70+9.40α, 254.85-0.75α) $c_3 = (c_3^L, c_3^R)$ =(252.80+4.85α, 261.20-3.55α) $c_4 = (c_4^L, c_4^R)$ = (253.20+1.35α, 259.25-4.70α) $c_5 = (c_5^L, c_5^R)$ = (251.50+1.10α, 257.65-5.05α)	$C = (C^L, C^R)$ = (1120.00 + 60.50 α, 1215.00-34.50α)

Step 3: The optimal solution of a fluffy non-linear programming problem with five components of left and right interval α-cut can be expressed as follows. The left interval α-cut is

$$\frac{\partial}{\partial R_i^L}[R_S^L] = \lambda[\frac{\partial}{\partial R_i^L}(\tilde{c}_1^L R_1^L + \tilde{c}_2{}^L R_2^L + \tilde{c}_3{}^L R_3^L + \tilde{c}_4{}^L R_4^L + \tilde{c}_5{}^L R_5^L) - C^L]$$

$$\text{where} \quad R_S^L = R_1^L R_2^L R_3^L R_4^L R_5^L \qquad (5)$$

$$(\tilde{c}_1^L R_1^L + \tilde{c}_2{}^L R_2^L + \tilde{c}_3{}^L R_3^L + \tilde{c}_4{}^L R_4^L + \tilde{c}_5{}^L R_5^L) - C^L = 0 \qquad (6)$$

Similarly, the right interval α-cut is

$$\frac{\partial}{\partial R_i^R}[R_S^R] = \lambda[\frac{\partial}{\partial R_i^R}(\tilde{c}_1^R R_1^R + \tilde{c}_2{}^R R_2^R + \tilde{c}_3{}^R R_3^R + \tilde{c}_4{}^R R_4^R + \tilde{c}_5{}^R R_5^R) - C^R]$$

$$where \quad R_S^R = R_1^R R_2^R R_3^R R_4^R R_5^R \tag{7}$$

$$(\tilde{c}_1^R R_1^R + \tilde{c}_2{}^R R_2^R + \tilde{c}_3{}^R R_3^R + \tilde{c}_4{}^R R_4^R + \tilde{c}_5{}^R R_5^R) - C^R = 0 \tag{8}$$

Step 4: Applying left interval value of cost co-efficient and cost constraint in the equations (5) and (6) and right interval value of cost co-efficient and cost constraint in the equations (7) and (8) respectively and solving them then the reliability values are obtained and listed in the table 1 and 2.

Table 1: Left interval optimal solution of NSE price data

α	R_1^L	R_2^L	R_3^L	R_4^L	R_5^L	R_S^L
0.0	0.9256198	0.9154066	0.8860760	0.8846761	0.8906558	0.5915778
0.2	0.9344614	0.9182415	0.8922252	0.8932813	0.8994915	0.6151459
0.4	0.9432811	0.9210336	0.8983277	0.9018681	0.9083115	0.6393361
0.6	0.9520790	0.9237837	0.9043817	0.9104366	0.9171161	0.6641544
0.8	0.9608553	0.9264927	0.9103943	0.9189869	0.9259054	0.6896130
1.0	0.9696099	0.9291618	0.9163594	0.9275192	0.9346793	0.7157143

Table 2: Right interval optimal solution of NSE price data

α	R_1^R	R_2^R	R_3^R	R_4^R	R_5^R	R_S^R
0.0	0.9871737	0.9528928	0.9297271	0.9367207	0.9455511	0.7746191
0.2	0.9841955	0.9486455	0.9275596	0.9353877	0.9414744	0.7626536
0.4	0.9804082	0.9436260	0.9246285	0.9332867	0.9408539	0.7511236
0.6	0.9769325	0.9389151	0.9219902	0.9314823	0.9381038	0.7389970
0.8	0.9732787	0.9340413	0.9191825	0.9295080	0.9363984	0.7273088
1.0	0.9696099	0.9291618	0.9163594	0.9275192	0.9346793	0.7157143

Step 5: From the Table 1 and Table 2, the maximum reliability is identified with their fluffy membership values of α.

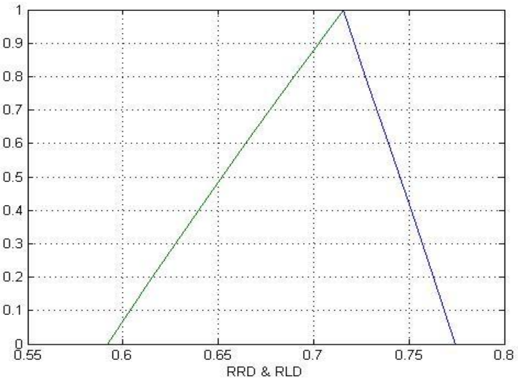

Fig. 1: Interval valued reliability of NSE price data

7. Conclusion

The fluffy non-linear programming problem is considered to quantify the most extreme unwavering quality subject to least cost. Table 1 shows the left interval optimum solution of NSE Price data subject to the cost constraints, which identifies that reliability for α = 0.0 is 0.5916. Table 2 shows the right interval optimum solution of NSE Price data for ICICI Bank subject to the cost constraints, which identifies that reliability for α = 0.0 is 0.7746. Figure 1 shows the interval valued reliability with triangular fluffy number and identify the maximum reliability is Rs = 0.7157. This analysis clearly shows that the NSE value of ICICI Bank which is taken for one week is more reliable subject to the price data.

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