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THE PRINCIPAL PIVOTING METHOD FOR SOLVING FUZZY QUADRATIC PROGRAMMING PROBLEM

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Abstract: In this paper, a new approach for solving the Fuzzy Quadratic Programming Problem (FQPP) is suggested. Here, the cost coefficients, constraint coefficients and the right hand side coefficients are represented by triangular fuzzy numbers. Here the approach is on the basis of α - cut sets of fuzzy numbers and the fuzzy number quadratic programming problems are reduced to interval number quadratic programming problem. The problem of quadratic programming with interval number coefficients is reduced to a Fuzzy Linear Complementarity Problem (FLCP) using the KKT conditions and the principal pivoting method is proposed to solve the formulated model. The effectiveness of the proposed method is illustrated by means of an example.

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1. Introduction

Many practical problems cannot be represented by linear programming model. Therefore, attempts were made to develop more general mathematical program-

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ming methods and many significant advances have been made in the area of nonlinear programming. The first major development was the fundamental paper by Kuhn - Tucker in 1951 [1] which laid the foundations for a good deal of later work in nonlinear programming. The linear complementarity problem (LCP) is a well known problem in mathematical programming and it has been studied by many researchers. In 1974, K. G. Murty [5] proposed a complementarity pivoting algorithm for solving linear complementarity problems. Since, the KKT conditions for quadratic programming problems can be written as a LCP. Principal Pivoting Method can be used to solve quadratic programming problems. Tong Shaocheng [9] focused on the fuzzy linear programming problems with interval numbers.

This paper provides a new technique for solving fuzzy quadratic programming problem by converting it into a fuzzy linear complementarity problem. Here the approach is on the basis of α - cut sets of triangular fuzzy numbers and the triangular fuzzy number linear complementarity problems are reduced into interval number linear complementarity problems. Then the converted interval number linear complementarity problem is solved at the value of α is 1. Here also the different level of α is calculated for verifying the optimal solution.

In this principal pivoting method the pivot element is chosen by the minimum ratio test. If the pivot element attains in a diagonal, then make a diagonal pivot. After a diagonal pivot operations, verify the right hand side column have any negative value, if no negative value then the obtained basis is the optimal solution. Otherwise, go to the next iteration and find the pivot element using the minimum ratio test. If the pivot element attains in a non diagonal, then make the non-diagonal pivot. Again verify the right hand side column have any negative value, if it have any negative then go to the next iteration without minimum ratio test. The pivot element is the complement of the leaving variable in the previous iteration. Make the iterations until the right hand side column has obtained positive value. If it positive, then the obtained solution is the optimal solution of the given fuzzy linear complementarity problem.

The paper is organized as follows: Section 2, introduces triangular fuzzy number, interval number and the fuzzy arithmetical operations for interval numbers. Fuzzy linear complementarity problem is discussed in Section 3. Section 4, deals with a Principal Pivoting Method (PPM) for solving a fuzzy linear complementarity problem. In Section 5, the conversion of FQPP to FLCP is discussed. Finally in Section 6, the effectiveness of the proposed method is illustrated by means of an example.

2. Preliminaries

Definition 1. (Fuzzy Set) A fuzzy set $\tilde{A}$ is defined by $\tilde{A}$= {(x, $\mu_A(x)$): x∈ A,$\mu_A(x) \in [0,1]$}.In the pair (x, μ_A(x)), the first element x belong to the classical set A, the second element $\mu_A(x)$, belong to the interval [0, 1], called Membership function

Definition 2. (Triangular Fuzzy Number) It is a fuzzy number represented with three points as follows: $\tilde{A} = (a_1, a_2, a_3)$. This representation in interpreted as membership functions

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & for \quad x < a_1 \\ \frac{x-a_1}{a_2-a_1} & for \quad a_1 \le x \le a_2 \\ \frac{a_3-x}{a_3-a_2} & for \quad a_2 \le x \le a_3 \\ 0 & for \quad x > a_3 \end{cases}$$

2.1. Operation of Triangular Fuzzy Number using Function Principle

Let $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$ be two triangular fuzzy numbers. Then

1. The addition of $\tilde{A}$ and $\tilde{B}$ is $\tilde{A} + \tilde{B} = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$ where $a_1, a_2, a_3, b_1, b_2, b_3$ are real numbers.

2. The product of $\tilde{A}$ and $\tilde{B}$ is $\tilde{A} \times \tilde{B} = (c_1, c_2, c_3)$, where T $= a_1b_1, a_2b_2, a_3b_3$ where $c_1 =$ min {T}, $c_2 = a_2b_2, c_3 =$ max {T}. If $a_1, a_2, a_3, b_1, b_2, b_3$ are all non zero positive real numbers, then $\tilde{A} \times \tilde{B} = (a_1b_1, a_2b_2, a_3b_3)$

3. $-\tilde{B} = (-b_3, -b_2, -b_1)$ Then the subtraction of $\tilde{B}$ from $\tilde{A}$ is $\tilde{A} - \tilde{B} = (a_1 - b_3, a_2 - b_2, a_3 - b_1)$, where $a_1, a_2, a_3, b_1, b_2, b_3$ are real numbers.

4. $\frac{1}{\tilde{B}} = \tilde{B}^{-1} = \left\{\frac{1}{b_3}, \frac{1}{b_2}, \frac{1}{b_1}\right\}$, where b_1, b_2, b_3 are all non zero real numbers, Then $\frac{\tilde{A}}{\tilde{B}} = (\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1})$.

Definition 3. (Interval Numbers) If $\tilde{A}$ is a triangular fuzzy number, we will let $\tilde{A}_\alpha = [A_\alpha^-, A_\alpha^+]$ be the closed interval which is a α - cut for $\tilde{A}$ where A_α^- and A_α^+ are its left and right end points respectively. Let I and J be two interval numbers defined by ordered pairs of real numbers with lower and upper bounds. I = [a, b], where a ≤ b, J = [c, d], where c ≤ d, when a = b and c = d, these interval numbers degenerate to a scalar real number.

2.2. Arithmetic Operations on Interval Numbers

The Arithmetic operations on I and J are given [4] below

1. **Addition:** I+J = [a,b]+[c,d] = [a+b,c+d], where a,b,c & d are any real numbers.

2. **Subtraction:** I-J = [a,b]-[c,d] = [a-d,b-c], where a,b,c & d are any real numbers.

3. **Multiplication:** I • J = [a,b]•[c,d] = [min(ac,ad,bc,bd), max(ac,ad,bc,bd)], where ac,ad,bc,bd are all arithmetic products.

4. **Division:** I/J=$\frac{[a,b]}{[c,d]} = [a, b] \bullet [\frac{1}{d}, \frac{1}{c}]$, provided 0 $\notin$[c,d], where $\frac{1}{d}$ and $\frac{1}{c}$ are quotients.

3. Linear Complementarity Problem (LCP)

Given a real n×n square matrix M and a n×1 real vector q, then the linear complementarity problem denoted by LCP(q, M) is to find real n×1 vector W, Z such that

$$W - MZ = q \tag{1}$$

$$W_j \geq 0, Z_j \geq 0, \quad \text{for} \quad j = 1, 2, ..., n \tag{2}$$

$$W_j Z_j = 0, \quad \text{for} \quad j = 1, 2, ..., n \tag{3}$$

Here the pair (W_j, Z_j) is said to be a pair of complementarity variables.

A solution (W, Z) to the above system is called a complementarity feasible solution, if (W, Z) is a basic feasible solution to (1) and (2) with one of the pair (W_j, Z_j) is basic for j = 1,2,...,n. If q ≥ 0, then we immediately see that W = q, Z = 0 is a solution to the linear complementarity problem. If however, q ≤ 0, we consider the related system,

$$W - MZ - eZ_0 = q \tag{4}$$

$$W_j \geq 0, Z_j \geq 0, Z_0 \geq 0 \quad \text{for} \quad j = 1, 2, ..., n \tag{5}$$

$$W_j Z_j = 0, \quad \text{for} \quad j = 1, 2, ..., n \tag{6}$$

Where Z_0 is an artificial variable and e is an n - vector with all components equal to one.

Letting Z_0 = maximum $\{-q_i \backslash 1 \leq i \leq n\}$, Z = 0, and $W = q + eZ_0$, we obtain a starting solution to the above system.

3.1. Fuzzy Linear Complementarity Problem (FLCP)

Assume that all parameters in (1) - (3) are fuzzy and are described by triangular fuzzy numbers. Then the following fuzzy Linear Complementarity Problem can be obtained by replacing crisp parameters with triangular fuzzy numbers.

$$\tilde{w} - \tilde{M}\tilde{z} = \tilde{q},$$

$$\tilde{w}_i, \tilde{z}_i \geq 0, \quad \text{for} \quad i = 1, 2, ..., n,$$

and

$$\tilde{w}_i \tilde{z}_i = 0, \quad \text{for} \quad i = 1, 2, ..., n.$$

The pair $(\tilde{w}_i, \tilde{z}_i)$ is said to be a pair of fuzzy Complementarity variables.

4. Principal Pivoting Method

G. B. Dantzig and R. W. Cottle [5] suggested an algorithm for solving linear complementarity problems. Based on this idea, an algorithm for solving fuzzy linear complementarity problem is developed here. Initially the given fuzzy quadratic programming problem is converted into fuzzy linear complementarity problem and the triangular fuzzy number is reduced into interval number by using α - cut. Then the interval number linear complementarity problem is solved by using the following principal pivoting method.

Step 0. Initialization. Set k=0. Begin with the system $\tilde{w}^k = \tilde{M}\tilde{z}^k + \tilde{q}^k$.

Step 1. Test for Termination. If $\tilde{q}^k \geq 0$, then stop. $\tilde{z}^k = 0$ solves $(\tilde{q}^k, \tilde{M}^k)$. That is $(\tilde{w}^k, \tilde{z}^k) = (\tilde{q}^k, 0)$ is the solution. Otherwise, choose some $\tilde{q}_t^k < 0$, and let $\tilde{w}_t^k$ be the leaving variable.

Step 2. Choose Pivot Row. Determine the entering variable by letting t by the minimum ratio test. $\frac{\tilde{q}_t}{\tilde{m}_{ts}}$ =minimum $\left\{ \frac{\tilde{q}_i}{\tilde{m}_{is}} \quad \backslash i = 1 \quad to \quad n \right\}$ Hence one of the basic variables goes to zero. (i.e) $\tilde{w}_t^k = 0$.

Step 3. Pivoting. If $\tilde{z}_t^k$ is blocked by $\tilde{w}_t^k$ then pivot on $\tilde{m}_{tt}$, replace k by k+1 and go to step 1.

If $\tilde{z}_t^k$ is blocked by $\tilde{w}_i^k, i \neq t$ then pivot on $\tilde{m}_{it}$, replace k by k+1 and go to step 2. The complement of the leaving variable is the new entering variable in the next iteration. Pivot operations are similar to the simplex method.

4.1. Numerical Example

Consider the Fuzzy Linear Complementarity Problems$(\tilde{q}, \tilde{M})$, with triangular fuzzy number is,

$$\tilde{M} = \begin{pmatrix} (1.75,2,2.25) & (0.75,1,1.25) & (0.75,1,1.25) \\ (0.75,1,1.25) & (1.75,2,2.25) & (0.75,1,1.25) \\ (0.75,1,1.25) & (0.75,1,1.25) & (1.75,2,2.25) \end{pmatrix}$$

$$\tilde{q} = \begin{pmatrix} (-4.25,-4,-3.75) \\ (-5.25,-5,-4.75) \\ (-1.25,-1,-0.75) \end{pmatrix}$$

The above problem can be written in the simplex table format:

Basic Variables	$\tilde{w}_1$	$\tilde{w}_2$	$\tilde{w}_3$	$\tilde{z}_1$	$\tilde{z}_2$	$\tilde{z}_3$	$\tilde{q}$
$\tilde{w}_1$	(0.75,1,1.25)	(0,0,0)	(0,0,0)	(-2.25,-2,-1.75)	(-1.25,-1,-0.75)	(-1.25,-1,-0.75)	(-4.25,-4,-3.75)
$\tilde{w}_2$	(0,0,0)	(0.75,1,1.25)	(0,0,0)	(-1.25,-1,-0.75)	(-2.25,-2,-1.75)	(-1.25,-1,-0.75)	(-5.25,-5,-4.75)
$\tilde{w}_3$	(0,0,0)	(0,0,0)	(0.75,1,1.25)	(-1.25,-1,-0.75)	(-1.25,-1,-0.75)	(-2.25,-2,-1.75)	(-1.25,-1,-0.75)
$\tilde{w}_1$	(0.75,1,1.25)	(-3.76,-2,-1.05)	(0,0,0)	(-1.2,0,2)	(1.25,3,6)	(-0.2,1,3)	(2.45,6,12.1)
$\tilde{z}_1$	(0,0,0)	(-1.67,-1,-0.6)	(0,0,0)	(0.6,1,1.67)	(1.4,2,3)	(0.6,1,1.67)	(3.8,5,7)
$\tilde{w}_3$	(0,0,0)	(-2.1,-1,-0.45)	(0.75,1,1.25)	(-0.8,0,1.4)	(-0.2,1,3)	(-1.8,-1,0.35)	(1.65,4,8)
$\tilde{z}_2$	(0.13,0.33,1)	(-3,-0.67,-0.18)	(0,0,0)	(-0.96,0,1.6)	(0.21,1,2.9)	(-0.2,0.33,2.4)	(0.41,2,9.7)
$\tilde{z}_1$	(-3,-0.67,-0.18)	(-1.42,0.34,8.4)	(0,0,0)	(-4.2,1,4.57)	(-7.3,0,2.7)	(-6.6,0.33,1.07)	(-5.3,1,6.4)
$\tilde{w}_3$	(-3,-0.33,0.2)	(-2.7,-0.33,8.6)	(0.75,1,1.25)	(-5.6,0,4.3)	(-8.9,0,3.6)	(-9,-1.33,0.95)	(-7.5,2,10)

Hence the optimal solution of the given fuzzy linear complementarity problem is given by,

$$(\tilde{w}_1, \tilde{w}_2, \tilde{w}_3 : \tilde{z}_1, \tilde{z}_2, \tilde{z}_3)$$
$$= ((0,0,0),(0,0,0),(-7.5,2,10) : (-5.3,1,6.4),(0.41,2,9.7),(0,0,0)).$$

5. Application

Procedure for convert the Fuzzy Quadratic Programming Problem (FQPP) into Fuzzy Linear Complementarity Problem (FLCP).

Let us consider the following FQPP,
Minimize $\tilde{f}(\tilde{X}) = \tilde{C}\tilde{X} + \frac{1}{2}\tilde{X}^T\tilde{H}\tilde{X}$
Subject to the constraints

$\tilde{A}\tilde{X} \leq \tilde{b}$
$\tilde{X} \geq 0.$
where $\tilde{C}$ is an n - vector of fuzzy numbers, $\tilde{b}$ is an m - vector, $\tilde{A}$ is an mxn fuzzy matrix and $\tilde{H}$ is an nxn fuzzy symmetric matrix. Let $\tilde{Y}$ denote the vector of slack variables and $\tilde{u}, \tilde{v}$ be the Lagrangian multiplier vectors of the constraints $\tilde{A}\tilde{X} \leq \tilde{b}$ and $\tilde{X} \geq 0$, respectively. The Kuhn - Tucker conditions can then be written as,

$$\tilde{A}\tilde{X} + \tilde{Y} = \tilde{b},$$
$$-\tilde{H}\tilde{X} - \tilde{A}^T\tilde{u} + \tilde{v} = \tilde{C},$$
$$\tilde{X}^T\tilde{v} = 0, \tilde{u}^T\tilde{Y} = 0,$$
$$\tilde{X}, \tilde{Y}, \tilde{u}, \tilde{v} \geq 0.$$

Now

$$\tilde{M} = \begin{bmatrix} \tilde{0} & -\tilde{A} \\ \tilde{A}^T & \tilde{H} \end{bmatrix}, \tilde{q} = \begin{bmatrix} \tilde{b} \\ \tilde{c} \end{bmatrix}, \tilde{w} = \begin{bmatrix} \tilde{Y} \\ \tilde{v} \end{bmatrix} and \tilde{Z} = \begin{bmatrix} \tilde{u} \\ \tilde{X} \end{bmatrix}.$$

The Kuhn-Tucker conditions can be expressed as the LCP

$$\tilde{W} - \tilde{M}\tilde{Z} = \tilde{q},$$
$$\tilde{W}^T\tilde{Z} = 0,$$
$$(\tilde{W}, \tilde{Z}) \geq 0.$$

Thus the given FQPP is converted into the above FLCP.

6. Illustrative Example

Consider the following Fuzzy Quadratic Programming Problem (FQPP)
Minimize $\tilde{f} = -\tilde{4}\tilde{x}_1 + \tilde{x}_1^2 - \tilde{2}\tilde{x}_1\tilde{x}_2 + \tilde{2}\tilde{x}_2^2$
Subject to the constraints,
$\tilde{2}\tilde{x}_1 + \tilde{x}_2 \leq \tilde{6}$
$\tilde{x}_1 - \tilde{4}\tilde{x}_2 \leq \tilde{0}$
$\tilde{x}_1, \tilde{x}_2 \geq \tilde{0}.$
Here

$$\tilde{A} = \begin{bmatrix} \tilde{2} & \tilde{1} \\ \tilde{1} & -\tilde{4} \end{bmatrix}, \tilde{H} = \begin{bmatrix} \tilde{2} & -\tilde{2} \\ -\tilde{2} & \tilde{4} \end{bmatrix}, \tilde{b} = \begin{bmatrix} \tilde{6} \\ \tilde{0} \end{bmatrix} \tilde{c} = \begin{bmatrix} -\tilde{4} \\ \tilde{0} \end{bmatrix}$$

For solving the above FQPP, we first reduce it into the following interval number quadratic programming problem by taking different α - cuts.

When $\alpha = 1$, the given model can be written as:

Minimize $f = [-4,-4]X_1 + [1,1]X_1^2 + [-2,-2]X_1X_2 + [2,2]X_2^2$.
Subject to the constraints:
$[2,2]X_1 + [1,1]X_2 \leq [6,6]$,
$[1,1]X_1 + [-4,-4]X_2 \leq [0,0]$,
$X_1, X_2 \geq 0$.

Now, the interval number quadratic programming problem is converted into a linear complementarity problem and hence solved by the proposed method.

The above problem can be written in the simplex table format.

Basic Variables	$\tilde{w}_1$	$\tilde{w}_2$	$\tilde{w}_3$	$\tilde{w}_4$	$\tilde{z}_1$	$\tilde{z}_2$	$\tilde{z}_3$	$\tilde{z}_4$	$\tilde{q}$
$\tilde{w}_1$	[1,1]	[0,0]	[0,0]	[0,0]	[0,0]	[0,0]	[2,2]	[1,1]	[6,6]
$\tilde{w}_2$	[0,0]	[1,1]	[0,0]	[0,0]	[0,0]	[0,0]	[1,1]	[-4,-4]	[0,0]
$\tilde{w}_3$	[0,0]	[0,0]	[1,1]	[0,0]	[-2,-2]	[-1,-1]	[-2,-2]	[2,2]	[-4,-4]
$\tilde{w}_4$	[0,0]	[0,0]	[0,0]	[1,1]	[-1,-1]	[4,4]	[2,2]	[-4,-4]	[0,0]
$\tilde{w}_1$	[1,1]	[0,0]	[1,1]	[0,0]	[-2,-2]	[-1,-1]	[0,0]	[3,3]	[2,2]
$\tilde{w}_2$	[0,0]	[1,1]	[0.5,0.5]	[0,0]	[-1,-1]	[-0.5,-0.5]	[0,0]	[-3,-3]	[-2,-2]
$\tilde{z}_3$	[0,0]	[0,0]	[-0.5,-0.5]	[0,0]	[1,1]	[0.5,0.5]	[1,1]	[-1,-1]	[2,2]
$\tilde{w}_4$	[0,0]	[0,0]	[1,1]	[1,1]	[-3,-3]	[3,3]	[0,0]	[-2,-2]	[-4,-4]
$\tilde{w}_1$	[1,1]	[-2,-2]	[0,0]	[0,0]	[0,0]	[0,0]	[0,0]	[9,9]	[6,6]
$\tilde{z}_2$	[0,0]	[-2,-2]	[-1,-1]	[0,0]	[2,2]	[1,1]	[0,0]	[6,6]	[4,4]
$\tilde{z}_3$	[0,0]	[1,1]	[0,0]	[0,0]	[0,0]	[0,0]	[1,1]	[-4,-4]	[0,0]
$\tilde{w}_4$	[0,0]	[6,6]	[4,4]	[1,1]	[-9,-9]	[0,0]	[0,0]	[-20,-20]	[-16,-16]
$\tilde{w}_1$	[1,1]	[0.7,0.7]	[1.8,1.8]	[0.45,0.45]	[-4.05,-4.05]	[0,0]	[0,0]	[0,0]	[-1.2,-1.2]
$\tilde{z}_2$	[0,0]	[-0.2,-0.2]	[0.2,0.2]	[0.3,0.3]	[-0.7,-0.7]	[1,1]	[0,0]	[0,0]	[-0.8,-0.8]
$\tilde{z}_3$	[0,0]	[-0.2,-0.2]	[-0.8,-0.8]	[-0.2,-0.2]	[1.8,1.8]	[0,0]	[1,1]	[0,0]	[3.2,3.2]
$\tilde{z}_4$	[0,0]	[-0.3,-0.3]	[-0.2,-0.2]	[-0.05,-0.05]	[0.45,0.45]	[0,0]	[0,0]	[1,1]	[0.8,0.8]
$\tilde{w}_1$	[1,1]	[1.86,1.86]	[0.64,0.64]	[-1.29,-1.29]	[0,0]	[5.79,5.79]	[0,0]	[0,0]	[3.43,3.43]
$\tilde{z}_1$	[0,0]	[0.29,0.29]	[-0.29,-0.29]	[-0.43,-0.43]	[1,1]	[-1.43,-1.43]	[0,0]	[0,0]	[1.14,1.14]
$\tilde{z}_3$	[0,0]	[-0.71,-0.71]	[-0.29,-0.29]	[0.57,0.57]	[0,0]	[2.57,2.57]	[1,1]	[0,0]	[1.14,1.14]
$\tilde{z}_4$	[0,0]	[-0.43,-0.43]	[-0.07,-0.07]	[0.14,0.14]	[0,0]	[0.64,0.64]	[0,0]	[1,1]	[0.29,0.29]
$\tilde{w}_2$	[0.54,0.54]	[1,1]	[0.35,0.35]	[-0.69,-0.69]	[0,0]	[-3.12,-3.12]	[0,0]	[0,0]	[1.85,1.85]
$\tilde{z}_1$	[-0.15,-0.15]	[0,0]	[-0.38,-0.38]	[-0.23,-0.23]	[1,1]	[-0.54,-0.54]	[0,0]	[0,0]	[0.62,0.62]
$\tilde{z}_3$	[0.38,0.38]	[0,0]	[-0.04,-0.04]	[0.08,0.08]	[0,0]	[0.35,0.35]	[1,1]	[0,0]	[2.46,2.46]
$\tilde{z}_4$	[0.23,0.23]	[0,0]	[0.08,0.08]	[-0.15,-0.15]	[0,0]	[-0.69,-0.69]	[0,0]	[1,1]	[1.08,1.08]

Here the bold values are represented as the pivot element. Hence the optimal solution of the given FQPP is $X_1 = [2.46, 2.46], X_2 = [1.08, 1.08]$ and Minimize f = [-6.769, -6.769].

Results obtain by different levels of α-cut:

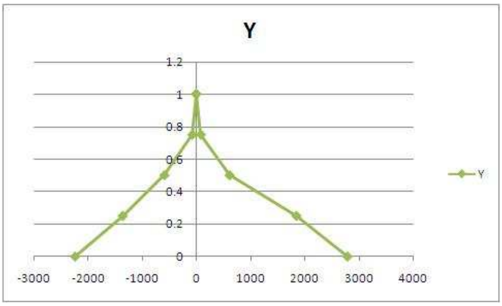

Figure 1: X_1

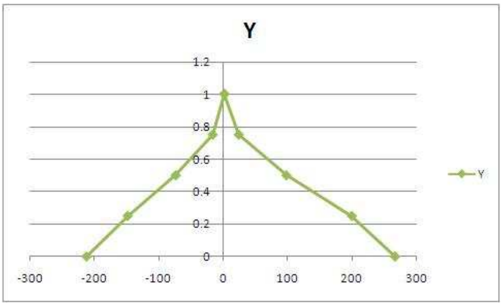

Figure 2: X_2

α	X_1	X_2	f
0	[-2232,2792]	[-213,266]	[-8042103,9302017]
0.25	[-1352,1850]	[-149,199]	[-3380137,4181243]
0.50	[-583,618]	[-74.3,97.4]	[-506472,705489]
0.75	[-68,88.2]	[-17.1,23.5]	[-8729,9476]
1	[2.46,2.46]	[1.08,1.08]	[-6.769,-6.769]

The *Excel* output for the following above Results obtain by different levels of α - cut are given by

7. Conclusion

In this paper, a new approach for solving a fuzzy quadratic programming problem by converting it into a fuzzy linear complementarity problem is suggested. The Procedure for convert the Fuzzy Quadratic Programming Problem (FQPP) into Fuzzy Linear Complementarity Problem (FLCP) is suggested. The maximum value of α gives the optimal solution of the given objective function.

Here, The Principal Pivoting Method is proposed to solve the given fuzzy linear complementarity problem with both the interval number and triangular fuzzy number. The effectiveness of the proposed method is verified with the different level of α-cut sets.

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