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The Soft Fuzzy Set In Electrical

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ABSTRACT

In this article, first the aggregation operator and the operational waves in the oscillators are introduced. Next, we choose a demanded Electrical waveform in the demanded oscillator using a model have been done. We use the fuzzy soft aggregation operator in the oscillators on L^2 space at the method can be successfully applied to many problems that contain uncertainties. Our simulation is done with *R* software.

1. Introduction

Considering the application of soft fuzzy set in basic sciences, engineering and medicine, we came to examine a type of application of this set in one of the technical and engineering disciplines. We examined this set and designed the soft internal multiplication in this application space with the help of space L^2 and definition, and the need for an operator in this design made us define the cumulative operator on the soft fuzzy set and examine its properties. We turned it into matrix operations so that we could get results for more complex calculations than software R. Software *R* is a programming language and software environment for statistical calculations and data science. It contains a wide range of statistical techniques of linear modeling and non-linear and graphic capabilities. To start the design, we had to define electric waves and their types and wave characteristics, and we did the design and calculations both manually and with the help of software and mentioned it. In soft fuzzy sets, the operator Cumulative is the best choice according to the desired criteria in the following articles, we will work on the use of this operator and how to select it in medical sciences.

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2. Preliminaries

In this section, we present the basic definitions of soft set theory [23] and fuzzy set theory [39] that are useful for subsequent discussions. These definitions and more detailed explanations related to the soft sets and fuzzy sets can be found in [4, 21, 23] and [41], respectively. Then we have defined f s-sets and their operations. In the soft sets, given in Section 2, the parameter sets and the approximate functions are crisp. But in the fs-sets, while the parameters sets are crisp, the approximate functions are fuzzy subsets of U. From now on, we will use Γ_A, Γ_B, Γ_C ,..., etc. for fs-sets and μ_A , μ_B, μ_C ,…, etc. for their fuzzy approximate functions, respectively. Throughout this work, U refers to an initial universe, E is a set of parameters, $P(U)$ is the power set of U, and $A \subseteq E$.

Definition 1: A soft set f_A over U *is* a set defined by a function f_A representing a mapping

$$f_A : f \rightarrow P(U) \text{ such that } f_A(x) = \phi \quad \text{if} \quad x \notin A.$$

Here, f_A is called approximate function of the soft set f_A, and the value $f_A(x)$ is a set called *x-element* of the soft set for all $x \in E$. It is worth noting that the sets $f_A(x)$ may be arbitrary, empty, or have nonempty intersection. Thus a soft set over U can be represented by the set of ordered pairs:

$$f_A = \{(x, f_A(x)) : x \in E, f_A(x) \in \mathrm{P(U)}\}.$$

Note that the set of all soft sets over U will be denoted by $S(U)$.

Definition 2: Let U be a universe. A fuzzy set X over U is a set defined by a function

μ_E representing a mapping:

$$\mu_E : U \rightarrow [0,1],$$

μ_E is called the membership function of X, and the value $\mu_E(u)$ is called the grade of membership of $u \in U$. The value represents the degree of u belonging to the fuzzy set X. Thus, a fuzzy set X over U can be represented as follows:

$$X = \{ (\mu u X/u) : u \ U, \mu X\ (u), [0,1]\}.$$

Note that the set of all the fuzzy sets over U will be denoted by $F(U)$.

Definition 3: An fs-set Γ_A over U is a set defined by a function μ_A representing a mapping

$$\gamma_A : E \rightarrow F(U) \quad \text{such that} \quad \gamma_A(x) = \emptyset \ \text{ if } \ x \notin A.$$

Here, γ_A is called fuzzy approximate function of the fs-set FA, and the value $\gamma_A(x)$ is a set called

x-element of the fs-set for all $x \in E$. Thus, an fs-set Γ_A over U can be represented by the set of ordered pairs

$$\Gamma_A = \{(x, \mu_A(x)) : x \in E, \mu_A(x) \in F(U)\}.$$

Note that the set of all fs-set over U will be denoted by $FS(U)$.

Definition 4: Let $\Gamma_A \in FS(U)$. If $\mu_A(x) = \emptyset$ for all $x \in E$, then Γ_A is called an empty fs-set, denoted by $\Gamma_\emptyset$. denoted by $\Gamma_{\tilde{A}}$. If $A = E$, then the A-universal fs-set is called universal fs-set , denoted by $\Gamma_{\tilde{E}}$.

Definition 5. Let Γ_A, $\Gamma_A \in FS(U)$. Then, Γ_A is an fs-subset of Γ_B, denoted by $\Gamma_A \subseteq \Gamma_B$, if $\gamma_A(x) \subseteq \gamma_B(x)$ for all $x \in E$.

Definition 6: Let Γ_A, $\Gamma_B \in FS(U)$. Then, Γ_A and Γ_B are fs-equal, written as Γ_A and Γ_B , if and only if $\gamma_A(x) = \gamma_B(x)$ for all $x \in E$.

Definition 7: Let Γ_A , $\Gamma_B \in FS(U)$. Then, the union of Γ_A and Γ_B, denoted by $\Gamma_A \cap \Gamma_B$, is defined by its fuzzy approximate function

$$\gamma_{A\cap B}(x) = \gamma_A(x) \cap \gamma_B(x) \quad \text{for all} x \in E.$$

Definition 8: A vector space consists of a set V (elements of V are called vec-tors), a field F (elements of Fare called scalars), and two operations. An operation called vector addition that takes two vectors $v, w \in V$, and produces a third vector, written $v + w \in V$. An operation called scalar multiplication that takes a scalar $c \in F$ and a vector $v \in V$, and produces a new vector, written $cv \in V$. which satisfy the following conditions:

1. Associativity of vector addition: $(u + v) + w = u + (v + w)$ for all $u, v, w \in V$.
2. Existence of a zero vector: There is a vector in V, written 0 and called the zero vector, which has the property that $u + 0 = u$ for all $u \in V$.
3. Existence of negatives: For every $u \in V$, there is a vector inV, written $-u$ and called the negative of u, which has the property that $u + (-u) = 0$.
4. Associativity of multiplication: $(ab)u = a(bu)$ for any $a, b \in F$ and $u \in V$.
5. Distributivity: $(a + b)u = au + bu$ and $a(u + v) = au + av$ for all $a, b \in F$ and $u, v \in V$.
6. Unitarity: $1u = u$ for all $u \in V$.

Definition 9: If χ is a vector space over $F(₵, R)$, a semi-inner product on χ is a function $u: \chi \times \chi \to F$ such that all $\curlyvee, \beta$ in F and x, y, z in χ, the following conditions are satisfied:

a) $u(\curlyvee x + \beta y , z) = \curlyvee u(x, z) + \beta u(y, z)$
b) $u(x, \curlyvee y + \beta z) = \bar{\curlyvee} u(x, y) + \bar{\beta} u(x, z)$
c) $u(x, x) \geq 0$
d) $u(x, y) = u(y, x)$
e) $u(x, 0) = u(0, y) = 0$ for all x, y in χ.
f) if $u(x, x) = 0$,then $x = 0$, An inner product on χin this paper will be denoted by $< x, y >= u(x, y)$.

Corollary 1: if $<.,.>$ is a semi-innerproduct on χ and $\|x\| =< x, x >^{1/2}$.

For all x inχ ,then
a) $\|x + y\| \leq \|x\| + \|y\|$ for x, y in χ
b) $\|\curlyvee x\| = I\curlyvee I\|x\|$ *for* $\curlyvee$ *in* F *and* x *in* χ if $<.,.>$ is an inner product, then
c) $\|x\| = 0$ implies $x = 0$.

Definition 10: We defined spaces $L^P(R)$ for all $p \in [1, \infty]$. The case $p = 2$ plays a very special role [8]. We have:

$$L^2[0.2\pi] = \left\{ f: [0.2\pi] \to \mathbb{C} : \left(\int (|f|^2 \, dt)^{\frac{1}{2}} \right) < \infty \right\}$$

$$< f.g >= \int f.\bar{g}\, dt \quad : \text{for all} \quad f.g \in L^2[0.2\pi]$$

$$d(f - g) = \| f - g \| = [\int |f - g|^2 \, dt]^{\frac{1}{2}}.$$

In this article, we used the five types of electric waveforms (Figures 1-5) [3].

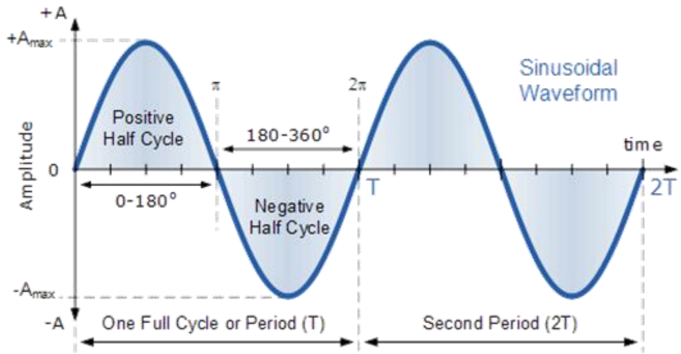


Figure 1. A Sine Wave Waveform

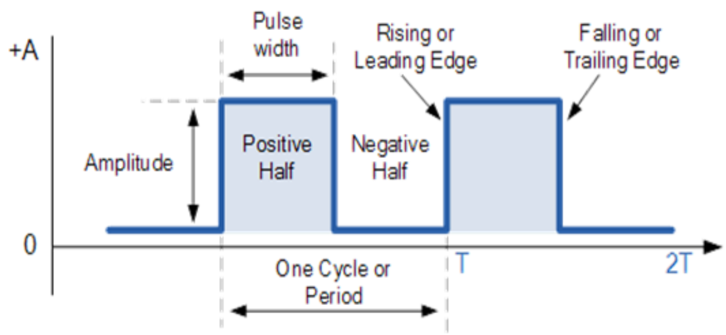


Figure 2. A Square Wave Waveform

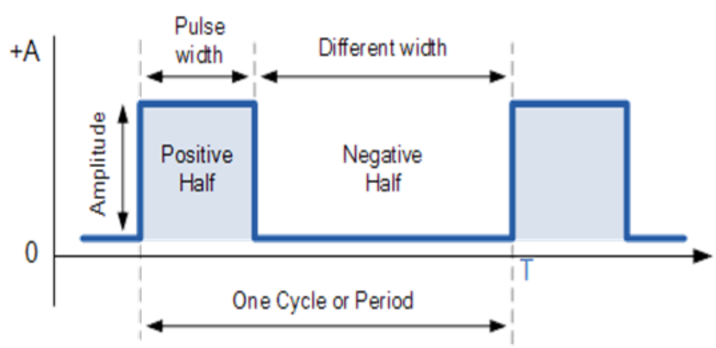


Figure 3. A Rectangular Waveform

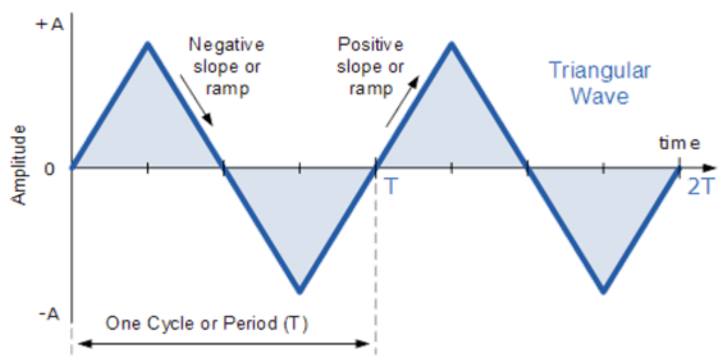


Figure 4. Triangular Waveform

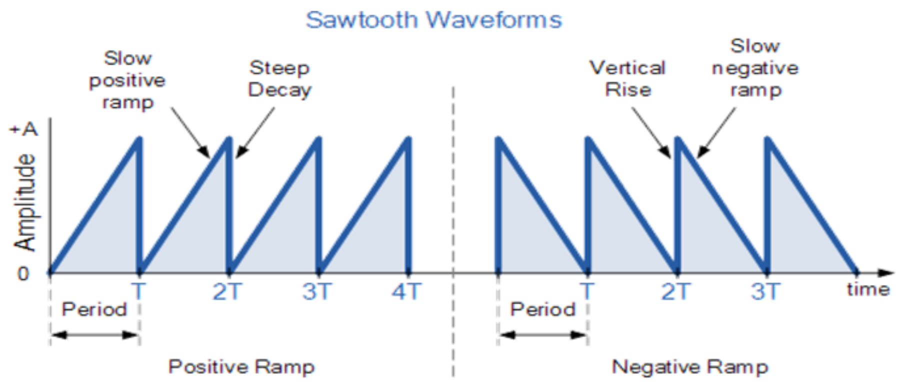


Figure 5. Saw tooth Waveforms

3. *fs*-aggregatiom

In this section, we define an fs-aggregation operator that produces an aggregate fuzzy set from an fs-set and its cardinal set. The approximate functions of an fs-set are fuzzy. An fs-aggregation operator on the fuzzy sets is an operation by which several approximate functions of an fs-set are combined to produce a single fuzzy set which is the aggregate fuzzy set of the fs-set. Once an aggregate fuzzy set has been arrived at, it may be necessary to choose the best single crisp alternative from this set.

Definition 11: Let $\Gamma_A \in FS(U)$. Assume that $U = \{u_1, u_2, u_3, \dots, u_m\}$, $E = \{s_1, s_2, s_3, \dots, s_m\}$, and $A \subseteq E$, then the Γ_A can be presented by Table 1:

Table 1. Membership function matrix

Γ_A	x_1	x_2	...	x_n
u_1	$\mu_{\gamma A(x_1)}(u_1)$	$\mu_{\gamma A(x_2)}(u_1)$	...	$\mu_{\gamma A(x_n)}(u_1)$
u_2	$\mu_{\gamma A(x_1)}(u_2)$	$\mu_{\gamma A(x_2)}(u_2)$	...	$\mu_{\gamma A(x_n)}(u_2)$
$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
U_m	$\mu_{\gamma A(x_1)}(u_m)$	$\mu_{\gamma A(x_2)}(u_m)$	...	$\mu_{\gamma A(x_n)}(u_m)$

where $\mu\gamma_A(x)(u)$ is the membership function of γ_A. If a_{ij} $\mu\gamma_A(x_j)(u_i)$, for $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$, then the *fs*-set Γ_A is uniquely characterized by a matrix,

$$[a_{ij}]_{m\times n} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

is called an $m\times n$ fs-matrix of the fs-set Γ_A over U.

Definition 12: Let $\Gamma_A \in FS(U)$. Then, the cardinal set of Γ_A, denoted by $c\Gamma_A$ and defined by

$$c\Gamma A = \{\mu c\Gamma A\,(x)\,/\,x : x \in E\},$$

is a fuzzy set over E. The membership function $\mu_{c\Gamma_A}$ of $c\Gamma_A$, is defined by

$$\mu_{c\Gamma_A} : E \to [0.1]\,. \quad \mu_{c\Gamma_A}(x) = \frac{|\gamma_A(x)|}{|U|},$$

where $|U|$ is the cardinality of universe U, and $\gamma_A(x)$ is the scalar cardinality of fuzzy set $\gamma_A(x)$.

Note that the set of all cardinal sets of the fs-sets over U will be denoted by cFS(U).

It is clear that $cFS(U) \subseteq F(E)$.

Definition 12: Let $\Gamma_A \in FS(U)$ and $c\Gamma_A \in cFS(U)$. Assume that $E = \{x_1, x_2, \ldots, x_m\}$ and $A \subseteq E$, then $c\Gamma_A$ can be presented by Table 2:

Table 2. Cardinal matrix

E	x_1	x_2	…	x_n
$\mu_{c\Gamma_A}$	$\mu_{c\Gamma_A}(x_1)$	$\mu_{c\Gamma_A}(x_2)$	…	$\mu_{c\Gamma_A}(x_n)$

If $a1_j = \mu c\Gamma A\ (x_j)$ for $j = 1, 2, \ldots, n$, then the cardinal set $c\Gamma A$ is uniquely characterized by a matrix,

$$[a_{1j}]_{1\times n} = [a_{11}\ a_{12}\ \ldots a_{1n}]$$

which is called the cardinal matrix of the cardinal set $c\Gamma_A$ over E.

Definition 14: Let $\Gamma_A \in FS(U)$ and $c\Gamma_A \in cFS(U)$. Then fs-aggregation operator, denoted by

$FSagg$, is defined by

$$FSagg:\ cFS(U) \times FS(U) \to F(U),\ \ FSagg(c\Gamma A, \Gamma A) = \Gamma_A^*$$

where $FSagg$ is a fuzzy set over U. Γ_A^* is called the aggregate fuzzy set of the fs-set Γ_A . The membership function $\mu_{\Gamma_A^*}$ of Γ_A^* is defined as follows:

$$\mu_{\Gamma_A^*}: U \to [0.1]. \qquad \mu_{\Gamma_A^*}(u) = \frac{1}{|E|}\sum_{x\in E} \mu_{c\Gamma_A}(x)\mu_{\gamma A}(x)\mu_{\gamma A(x)}(u),$$

where $|E|$ is the cardinality of E.

Definition 15: Let $\Gamma_A \in FS(U)$ and Γ_A be its aggregate fuzzy set. Assume that $U = \{u_1, u_2, u_3, \ldots, u_m\}$, then the Γ_A^* can be presented by Table 3:

Table 3. Aggregate matrix

Γ_A	$\mu_{\Gamma_A^*}$
u_1	$\mu_{\Gamma_A^*}(u_1)$
u_2	$\mu_{\Gamma_A^*}(u_2)$
⋮	⋮
u_m	$\mu_{\Gamma_A^*}(u_m)$

If $a_{s1} = \Gamma_A^*(us)$ for $s = 1, 2, \ldots, m$, then Γ_A^* is uniquely characterized by the matrix

$$[a_{ij}]_{m\times 1} = \begin{bmatrix} a_{11} \\ a_{21} \\ \vdots \\ a_{m1} \end{bmatrix}$$

which is called the aggregate matrix of Γ_A^* over U.

Theorem 1. Let $\Gamma_A \in FS(U)$ *and* $A \subseteq E$. If $M_{\Gamma A}$, $M_{c\Gamma_A}$ *and* $\mu\Gamma_A^*$ *are represtation matrixses* Γ_A, $c\Gamma_A$ *and* Γ_A^* *respectively, then*

$$|E| \times M_{\Gamma_A^*} = M_{\Gamma A} \times M_{c\Gamma_A}^T$$

where $M_{c\Gamma_A}^T$ *is the transposition of* $M_{c\Gamma_A}$ *and* $|E|$ *is the cardinality of* E.

Proof. It is sufficient to consider $[a_{i1}]_{m\times 1} = [a_{ij}]_{m\times n} \times [a_{1j}]^{T}_{1\times n}$.

Theorem 1, it is applicable to computing the aggregate fuzzy set of an fs-set.

4. Application

Once an aggregate fuzzy set has been arrived at, it may be necessary to choose the best alternative from this set. Therefore, we can make a decision by the following algorithm.

Step 1**:** Construct an fs-set Γ_A over U,
Step 2**:** Find the cardinal set $c\Gamma_A$ of Γ_A,
Step 3**:** Find the aggregate fuzzy set Γ_A^* of Γ_A,
Step 4**:** Find the best alternative from this set that has the largest member-ship grade by max $\mu\Gamma_A^*(u)$.

Example 1: Suppose a company wants to choose the desired wave from among the four waves in space to design its oscillators according to the criteria it considers. There are four candidates who form the set of alternatives. Let $U \in L^2[0,2\pi]$, $U = \{u_1, u_2, u_3, u_4\}$: u_1:sin wave , u_2:squre wave , u_3:triangular wave, u_4:sawtooth wave. Technical and Engineering Department company consider a set of parameters, $A = \{x_1, x_2, x_3\}$:.

For $s = 1, 2, 3$ the parameters x_s stand for "High energy", "Low slop"," The area under the curve is large", respectively. After a serious discussion each candidate is evaluated from the goals and constraint point of view of according to a chosen subset $A = \{x_1, x_2, x_3\}$ of E. Finally, Technical and Engineering Department company applies the following steps:

Step 1**:** The committee constructs an fs-set Γ_A over U,

$$\Gamma_A = \{ (x_1, \{0.38/u_1, 0.57/u_2, 1/u_3, 0.85/u_4\}), (x_2, \{0.21/u_1, 0.36/u_2, 1/u_3, 0.21/u_4\}), (x_3, \{1/u_1, 0/u_2, 0.5/u_3, 0/u_4\}) \}$$

Step 2**:** The cardinal is computed,

$$c\Gamma_A = \{0.7/x_1, 0.18/x_2, 0.375/x_3\}$$

Step 3**:** The aggregate fuzzy set is found by using Theorem 2.6,

$$M_{\Gamma_A^*} = \frac{1}{3}\begin{bmatrix} 0.38 & 0.21 & 1 \\ 0.57 & 0.3 & 0 \\ 1 & 1 & 0.5 \\ 0.85 & 0.21 & 0 \end{bmatrix}\begin{bmatrix} 0.7 \\ 0.18 \\ 0.375 \end{bmatrix} = \begin{bmatrix} 0.23 \\ 0.15 \\ 0.355 \\ 0.21 \end{bmatrix}$$

that means,

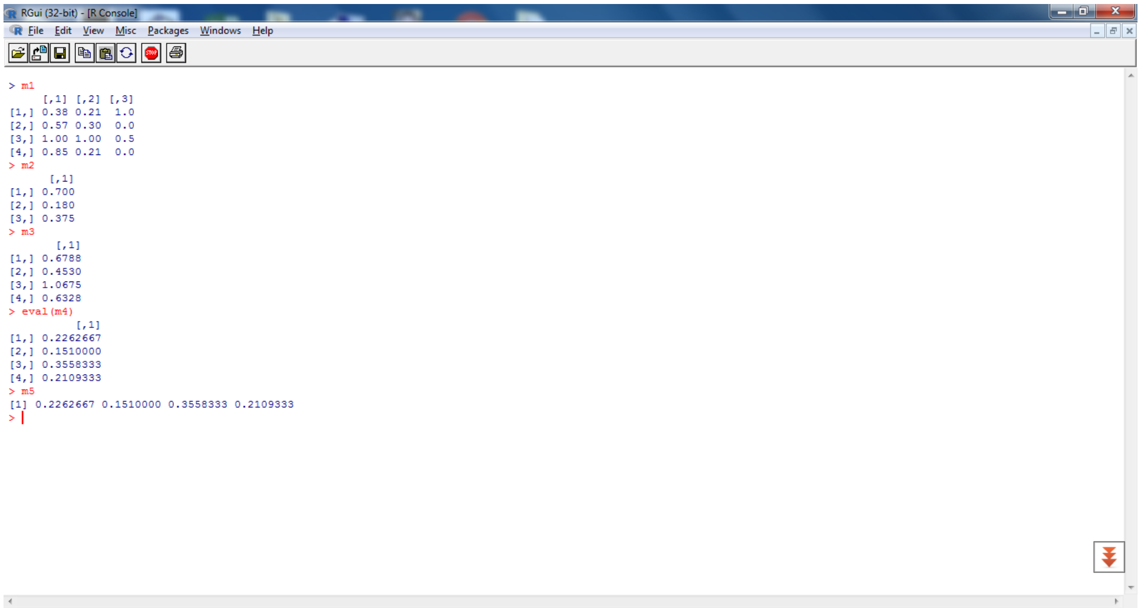
$$\Gamma_A^* = \{0.23/u_1, 0.15/u_2, 0.335/u_3, 0.21/u_4\}.$$

Step 4**:** Finally, the largest membership grade is chosen by

$$\max \mu_{\Gamma_A^*}(u) = 0.355,$$

which means that the candidate u_3 has the largest membership grade, hence he may be selected for the job.

Software separation calculations:



5. Conclusions

A soft set is a mapping from parameter to the crisp subset of universe. However, the situation may be more complicated in real world because of the fuzzy characters of the parameters. In fs-sets, the soft set theory is extended to a fuzzy one and then the fuzzy membership is used to describe parameter approximate elements of fuzzy soft set. To do this, we first defined the fs-sets and their operations. We then presented the decision making method for the fs-set theory. Finally, we provided an example demonstrating the successfully application of this method. It may be applied to many fields with problems that contain uncertainty, and it would be beneficial to extend the proposed method to subsequent studies. However, the approach should be more comprehensive in the future to solve the related problems.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Aktaş, H., & Çağman, N. (2007). Soft sets and soft groups. Information Sciences, 177(13), 2726-2735.
2. Ali, M. I., Feng, F., Liu, X., Min, W. K., & Shabir, M. (2009). On some new operations in soft set theory. Computers & Mathematics with Applications, 57(9), 1547-1553.
3. Ernst K., & Charles, D. (2018). Basic Appearance Of Circuits And Networks, First Volume, 32nd Ed.Tehran Univercity, Tehran,40-108.
4. Cagman, N., & Enginoğlu, S. (2010). Soft matrix theory and its decision making. Computers & Mathematics with Applications, 59(10), 3308-3314.
5. Cagman, N., & Enginoğlu, S. (2010). Soft set theory and uni–int decision making. European journal of Operational Research, 207(2), 848-855.
6. Cagman, N., Çıtak, F., & Enginoğlu, S. (2010). Fuzzy parameterized fuzzy soft set theory and its applications. Turkish Journal of Fuzzy System, 1(1), 21-35.
7. Chen, D., Tsang, E. C. C., Yeung, D. S., & Wang, X. (2005). The parameterization reduction of soft sets and its applications. Computers & Mathematics with Applications, 49(5-6), 757-763.

8. Conway, JB. (2007). A Course In Functional Analysis,2nd Ed.Speringer-Verlag,New York,1-25.
9. Dubois, D., & Prade, H. (1982). Fuzzy sets and systems: Theory and applications. American Mathematical society, 7(3), 603-612.Ernst K, Charles , D. (2018). Basic Appearance Of Circuits And Networks, First Volume, 32nd Ed.Tehran Univercity, Tehran,40-108.
10. Feng, F., Jun, Y. B., & Zhao, X. (2008). Soft semirings. Computers & Mathematics with Applications, 56(10), 2621-2628.
11. Jun, Y. B. (2008). Soft bck/bci-algebras. Computers & Mathematics with Applications, 56(5), 1408-1413.
12. Jun, Y. B., & Park, C. H. (2008). Applications of soft sets in ideal theory of BCK/BCI-algebras. Information Sciences, 178(11), 2466-2475.
13. Jun, Y. B., Kim, H. S., & Neggers, J. (2009). Pseudo d-algebras. Information Sciences, 179(11), 1751-1759.14.
14. Jun, Y. B., Lee, K. J., & Park, C. H. (2008). Soft set theory Applied to commutative ideals in BCK-algebras. Journal of Applied Mathematics & Informatics, 26(3_4), 707-720.
15. Jun, Y. B., Lee, K. J., & Park, C. H. (2009). Soft set theory Applied to ideals in d-algebras. Computers & Mathematics with Applications, 57(3), 367-378.
16. Kong, Z., Gao, L., & Wang, L. (2009). Comment on “A fuzzy soft set theoretic approach to decision making problems”. Journal of Computational and Applied Mathematics, 223(2), 540-542.
17. Kong, Z., Gao, L., Wang, L., & Li, S. (2008). The normal parameter reduction of soft sets and its algorithm. Computers & Mathematics with Applications, 56(12), 3029-3037.
18. Kovkov, D. V., Kolbanov, V. M., & Molodtsov, D. A. (2007). Soft sets theory-based optimization. Journal of Computer and Systems Sciences International, 46(6), 872-880.
19. Maji, P. K., Biswas, R. K., & Roy, A. (2001). Fuzzy Soft Sets. 9(3), 589-602.
20. Maji, P. K., Biswas, R., & Roy, A. (2003). Soft set theory. Computers & Mathematics with Applications, 45(4-5), 555-562.
21. Maji, P. K., Roy, A. R., & Biswas, R. (2002). An application of soft sets in a decision making problem. Computers & Mathematics with Applications, 44(8-9), 1077-1083.
22. Majumdar, P., & Samanta, S. K. (2008). Similarity measure of soft sets. New Mathematics and Natural Computation, 4(01), 1-12.
23. Molodtsov, D. (1999). Soft set theory-first results. Computers & Mathematics with Applications, 37(4-5), 19-31.
24. Molodtsov, D. A. (2001). The description of a dependence with the help of soft sets. J. Comput. Sys. Sc. Int, 40(6), 977-984.
25. Molodtsov, D. A. (2004). The theory of soft sets (in Russian). URSS Publishers, Moscow.
26. Molodtsov, D., Leonov, V. Y., & Kovkov, D. V. (2006). Soft Sets Technique and its Application. 1(1), 8-39.
27. Mukherjee, A., & Chakraborty, S. B. (2008). On intuitionistic fuzzy soft relations. Bulletin of Kerala Mathematics Association, 5(1), 35-42.
28. Mushrif, M. M., Sengupta, S., & Ray, A. K. (2006, January). Texture classification using a novel, soft-set theory based classification algorithm. In Asian Conference on Computer Vision (pp. 246-254). Springer, Berlin, Heidelberg.
29. Park, C. H., Jun, Y. B., & Öztürk, M. A. (2008). Soft WS-algebras. Commun. Korean Math. Soc, 23(3), 313-324.
30. Pawlak, Z. (1982). Rough sets. International journal of computer & information sciences, 11(5), 341-356.
31. Pei, D., & Miao, D. (2005, July). From soft sets to Information Systems. In 2005 IEEE International Conference on Granular Computing (Vol. 2, pp. 617-621). IEEE.
32. Roy, A. R., & Maji, P. K. (2007). A fuzzy soft set theoretic approach to decision making problems. Journal of Computational and Applied Mathematics, 203(2), 412-418.
33. Som, T. (2006). On the theory of soft sets, soft relation and fuzzy soft relation. In Proc. of the national conference on Uncertainty: A Mathematical Approach, UAMA-06, Burdwan 1-9.
34. Sun, Q. M., Zhang, Z. L., & Liu, J. (2008, May). Soft sets and soft modules. In International Conference on Rough Sets and Knowledge Technology (pp. 403-409). Springer, Berlin, Heidelberg.
35. Xiao, Z., Chen, L., Zhong, B., & Ye, S. (2005, June). Recognition for soft information based on the theory of soft sets. In Proceedings of ICSSSM'05. 2005 International Conference on Services Systems and Services Management, 2005. (Vol. 2, pp. 1104-1106). IEEE.

36. Xiao, Z., Gong, K., & Zou, Y. (2009). A combined forecasting approach based on fuzzy soft sets. Journal of Computational and Applied Mathematics, 228(1), 326-333.
37. Xiao, Z., Li, Y., Zhong, B., & Yang, X. (2003). Research on synthetically evaluating method for business competitive capacity based on soft set. Statistical Research, 10, 52-54.
38. Yang, X., Lin, T. Y., Yang, J., Li, Y., & Yu, D. (2009). Combination of interval-valued fuzzy set and soft set. Computers & Mathematics with Applications, 58(3), 521-527.
39. Yang, X., Yu, D., Yang, J., & Wu, C. (2007). Generalization of soft set theory: from crisp to fuzzy case. In Fuzzy Information and Engineering, Springer, Berlin, Heidelberg, 345-354.
40. Zadeh, L. A. (1965). Fuzzy sets. Information and Control, 8, 338-353.
41. Zimmermann, H. J. (2011). Fuzzy set theory and its applications. Springer Science & Business Media.
42. Zou, Y., & Chen, Y. (2008). Research on soft set theory and parameters reduction based on relational algebra. In 2008 Second International Symposium on Intelligent Information Technology Application (Vol. 1, pp. 152-156). IEEE.
43. Zou, Y., & Xiao, Z. (2008). Data analysis approaches of soft sets under incomplete information. Knowledge-Based Systems, 21(8), 941-945.

Zare, T., BenMohamand Khajeh, F., & Toranj, V. (2021). The Soft Fuzzy Set In Electrical *Fuzzy Optimization and Modelling Journal*, 2 (1), 12-21.

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