

Fuzzy Ideals in Near-subtraction Semigroups

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Abstract—In this paper, we introduce a notion of fuzzy ideals in near-subtraction semigroups and study their related properties.

Keywords—subtraction algebra, subtraction semigroup, an ideal, near-subtraction semigroup, fuzzy level set, fuzzy ideal, fuzzy homomorphism.

I. INTRODUCTION

THE systems of the form Φ , where $(\Phi; \circ, \setminus)$, considered by B. M. Schein [7], is a set of functions closed under the composition " \circ " of functions (and hence $(\Phi; \circ)$ is a function semigroup) and the set theoretic subtraction " \setminus " (and hence $(\Phi; \setminus)$ is a subtraction algebra in the sense of [1]). He proved that every subtraction semigroup is isomorphic to a difference semigroup of invertible functions. B.Zelinka [9] discussed a problem proposed by B. M. Schein concerning the structure of multiplication in a subtraction semigroup. He solved the problem for subtraction algebras of a special type, called the atomic subtraction algebras. Y. B. Jun et al. [3] introduced the notion of ideals in subtraction algebras and discussed characterization of ideals. In [4], Y. B. Jun and H. S. Kim established the ideal generated by a set, and discussed related results. Near-ring theory has been developed by Pöhl[6]. Based on near-ring theory, Dheena et al. [2], introduced the near-subtraction semigroups and strongly regular near-subtraction semigroups.

The concept of fuzzy subset was introduced by L.A.Zadeh [8]. Fuzzy set theory is a useful tool to describe situations in which the data are imprecise or vague. Fuzzy sets handle such situation by attributing a degree to which a certain object belongs to a set. K.J. Lee and C.H. Park[5] introduced the notion of a fuzzy ideal in subtraction algebras, and give some conditions for a fuzzy set to be a fuzzy ideal in subtraction algebras. In this paper, we introduce the notion of fuzzy ideal in near-subtraction semigroup and have studied their related properties.

II. PRELIMINARIES

Definition 2.1: A non-empty set X together with a binary operation " $-$ " is said to be a subtraction algebra if it satisfies the following:

- (1) $x = (y - x) = x$.
- (2) $x = (x - y) = y - (y - x)$.
- (3) $(x - y) - z = (x - z) - y$, for all $x, y, z \in X$.

Example 2.2: Let $X = \{0, a, b, 1\}$ in which " $-$ " is defined by

$-$	0	a	b	1
0	0	0	0	0
a	a	0	a	0
b	b	b	0	0
1	1	b	a	0

Then $(X, -)$ is a subtraction algebra.

In a subtraction algebra the following holds:

(P1) $x - 0 = x$ and $0 - x = 0$.

(P2) $(x - y) - x = 0$.

(P3) $(x - y) - y = x - y$.

(P4) $(x - y) - (y - x) = x - y$, where $0 = x - x$ is an element that does not depend on the choice of $x \in X$.

Following [9], we have the following definition of subtraction semigroup.

Definition 2.3: A non-empty set X together with the binary operations " $-$ " and " \cdot " is said to be a subtraction semigroup if it satisfies the following:

(SS1) $(X, -)$ is a subtraction algebra.

(SS2) (X, \cdot) is a semigroup.

(SS3) $x(y - z) = xy - xz$ and $(x - y)z = xz - yz$, for all $x, y, z \in X$.

Example 2.4: [2] Let $X = \{0, a, b, 1\}$ in which " $-$ " and " \cdot " are defined by

$-$	0	a	b	1
0	0	0	0	0
a	a	0	a	0
b	b	b	0	0
1	1	b	a	0

\cdot	0	a	b	1
0	0	0	0	0
a	0	a	0	a
b	0	0	b	b
1	0	a	b	1

Then $(X, -, \cdot)$ is a subtraction semigroup.

Now we have the following definition of near-subtraction semigroup.

Definition 2.5: A non-empty set X together with the binary operations " $-$ " and " \cdot " is said to be a near-subtraction semigroup if it satisfies the following:

(NS1) $(X, -)$ is a subtraction algebra.

(NS2) (X, \cdot) is a semigroup.

(NS3) $(x - y)z = xz - yz$, for all $x, y, z \in X$.

It is clear that $0x = 0$, for all $x \in X$. Similarly we can define a near-subtraction semigroup (left). Hereafter a near-subtraction semigroup means it is a near-subtraction semigroup (right) only.

Example 2.6: [2] Let $X = \{0, a, b, 1\}$ in which " $-$ " and " \cdot " are defined by

$-$	0	a	b	1
0	0	0	0	0
a	a	0	1	b
b	b	0	0	b
1	1	0	1	0

\cdot	0	a	b	1
0	0	0	0	0
a	a	a	a	a
b	a	0	1	b
1	0	a	b	1

Then $(X, -, \cdot)$ is a near-subtraction semigroup.

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Fuzzy Ideal In Near Subtraction Semirings

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