

STUDY OF SPECIAL ELEMENTS IN GROUP RINGS AND LOOP RINGS

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In this thesis special elements like S-zero-divisors, S-weak zero-divisors and S-idempotents are introduced and studied in the case of group rings and loop rings. Study of special elements is most important, for that alone can give the basic properties of the algebraic structure.

The specialty of this thesis is, the special elements of both non-associative rings and associative rings is studied and it is found that the associative identity happens to stand as hindrance in finding the number of S-zero-divisors and S-weak-zero-divisors. For even in case of group rings of very simple groups, it is not possible to find the number of S-zero-divisors and S-weak-zero-divisors. But on the other hands, using number theoretic methods, the exact number of S-zero-divisors and S-weak-zero-divisors are calculated for loop rings.

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Further in this thesis, conditions for the group rings and for the loop rings to have S-idempotents are obtained. It is proved that when G is a cyclic group of order $2mp$, where p is the prime of the form $2m_{t+1}$ ($m, t \in \mathbb{N}$) then the group ring Z_2G has non-trivial S-idempotents. Also for the loop ring $Z_tL_n(m)$ where t is an even perfect number, the existence of S-idempotent is shown. Most of the results exploit number theoretic techniques.

This thesis also introduces new Smarandache special elements and using these new Smarandache special elements, new algebraic structures like Smarandache unit domain, Smarandache unit free domain and Smarandache pseudo commutative ring are defined. Finally some interesting research problems are given.

Parts of this thesis have been published as the following papers.

1. *Smarandache Zero-Divisors in group rings*, Smarandache Notions Journal.
2. *On the Number of Smarandache Zero-Divisors and Smarandache Weak Zero-divisors in loop rings of the loops $L_n(m)$* , Scientia Magna, 1, (2005) 96-108.
3. *Smarandache idempotents in Loop Rings $Z_tL_n(m)$ of the Loops $L_n(m)$* , Scientia Magna, 1, (2005) 188-195.
4. *Smarandache idempotents in finite ring Z_n and in the group ring Z_nG* , Scientia Magna, 1, (2005) 179-187.

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