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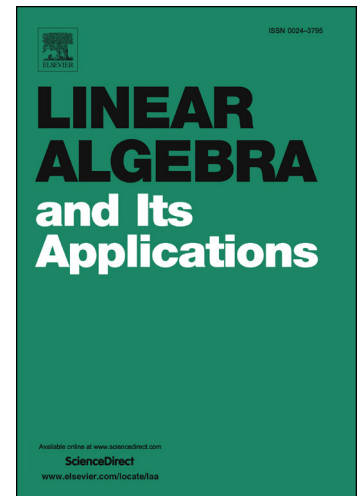
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## ON SKEW LAURENT POLYNOMIAL RINGS OVER LOCALLY NILPOTENT RINGS

MIKHAIL CHEBOTAR

ABSTRACT. Let  $R$  be a locally nilpotent ring. Let  $\sigma$  be an endomorphism of  $R$  and let  $\delta$  be a  $\sigma$ -derivation of  $R$ . Then the skew Laurent polynomial ring  $R[X, X^{-1}; \sigma, \delta]$  does not contain a non-zero idempotent. This answers a question posed by Greenfeld, Smoktunowicz and Ziemkowski.

### 1. INTRODUCTION

In our paper [3] we suggested that the Linear Algebraic methods can be of a great use for some important problems in Ring Theory including the most famous open problem known as the Koethe Conjecture. The purpose of this paper is to show how a triangularization technique developed by Mesyan [5] can be applied to solve a problem posed by Greenfeld, Smoktunowicz and Ziemkowski [4].

Let  $\sigma$  be an endomorphism of a ring  $R$  and let  $\delta$  be a  $\sigma$ -derivation, that is  $\delta : R \rightarrow R$  is an additive map such that

$$\delta(ab) = \sigma(a)\delta(b) + \delta(a)b, \quad \text{for all } a, b \in R.$$

Now consider the set of finite sums  $\sum_{i=m}^n a_i X^i$  where  $m \leq n$  are integers, addition is defined componentwise, and multiplication is given by the multiplication in  $R$ , the distributive law and the condition

$$Xa = \sigma(a)X + \delta(a), \quad \text{for all } a \in R.$$

In the case when multiplication is well-defined (i.e. the product of two such finite sums is a finite sum again) this set is a ring called a (*left skew (or twisted) Laurent polynomial ring*), and is denoted by  $R[X, X^{-1}; \sigma, \delta]$ .

In their interesting recent paper Greenfeld, Smoktunowicz and Ziemkowski asked the following questions [4, Question 6.6]: Is there  $R$  with no non-zero

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