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Explicit Solutions of Infinite Systems of Linear Equations from Reflexive Generalized Inverses of finite potent endomorphisms

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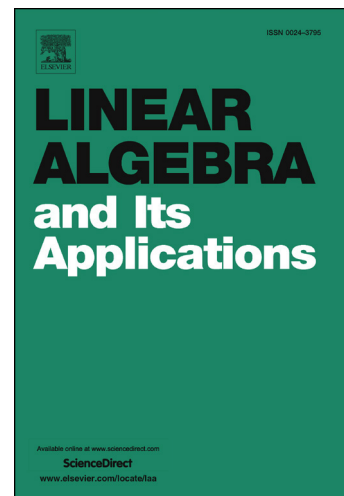
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**EXPLICIT SOLUTIONS OF INFINITE SYSTEMS OF LINEAR  
EQUATIONS FROM REFLEXIVE GENERALIZED INVERSES  
OF FINITE POTENT ENDOMORPHISMS**

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ABSTRACT. The aim of this work is to offer a method for computing reflexive generalized inverses of finite potent endomorphisms, that can be applied to obtain explicit solutions of infinite systems of linear equations.

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1. INTRODUCTION

Let  $k$  be a fixed ground field and  $V$  a vector space over  $k$ . If we consider an endomorphism  $\varphi$  of  $V$ , according to [5] it can be said that  $\varphi$  is “finite-potent” if  $\varphi^n V$  is finite dimensional for some  $n$ .

The definition of a reflexive generalized inverse of a singular  $n \times n$ -matrix is well-known. From this definition, reflexive generalized inverses of endomorphisms of finite-dimensional vector spaces make sense. Given an arbitrary  $k$ -vector space, the aim of this work is to offer a method for computing reflexive generalized inverses of a finite potent endomorphism  $\varphi$ . Thus, for each Jordan basis  $B$  of  $V$  determined by  $\varphi$ , we shall construct a reflexive generalized inverse  $\varphi_B^\dagger$  of  $\varphi$ . The linear map  $\varphi_B^\dagger \in \text{End}_k(V)$  depends on the choice of the basis  $B$ , is also finite potent, and is equivalent to  $\varphi$  under the action of the group of automorphisms of  $V$ .

As an application of this construction we shall obtain explicit solutions of infinite systems of linear equations. For an index family  $I$ , we shall compute the solutions on  $\prod_{i \in I} k$  of a system of linear equations

$$(1.1) \quad \left\{ \sum_{i \in I} a_{ij} x_j = \alpha_i \right\}_{i \in I},$$

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*Key words and phrases.* vector space, generalized inverse, finite potent endomorphism, infinite linear system.

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