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On congruence-semisimple semirings and the K_0 -group characterization of ultramatrix algebras over semifields

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Abstract

In this paper, we provide a complete description of congruence-semisimple semirings and introduce the pre-ordered abelian Grothendieck groups $K_0(S)$ and $SK_0(S)$ of the isomorphism classes of the finitely generated projective and strongly projective S -semimodules, respectively, over an arbitrary semiring S . We prove that the SK_0 -groups and K_0 -groups are complete invariants of, *i.e.*, completely classify, ultramatrix algebras over a semifield F . Consequently, we show that the SK_0 -groups completely characterize zerosumfree congruence-semisimple semirings.

Keywords: congruence-semisimple semiring, projective semimodule, strongly projective semimodule, K_0 -group, ultramatrix algebra
2010 MSC: Primary 16Y60, 16E20, 18G05

1. Introduction

As is well-known (see, for example, [5]), projective modules play a fundamental role in developing algebraic K -theory which, in turn, has crucial outcomes in many areas of modern mathematics such as topology, geometry, number theory, functional analysis, etc. In short, algebraic K -theory is a study of groups of the isomorphism classes of algebraic objects, the first of which is $K_0(R)$, Grothendieck's group of the isomorphism classes of finitely generated projective R -modules, and that is used to create a sort of dimension for R -modules that

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