

Symmetry Properties of Linear Algebraic Systems with Non-Canonical Scalar Multiplication

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Abstract : The research paper presents an in-depth analysis of symmetry properties in linear algebraic systems under the operation of non-canonical scalar multiplication structures, specifically semirings, and near-rings. The objective is to unveil the profound alterations that occur in traditional linear algebraic structures when we replace conventional field multiplication with these non-canonical operations. In the methodology, we first establish the theoretical foundations of non-canonical scalar multiplication, followed by a meticulous investigation into the resulting symmetry properties, focusing on eigenvectors, eigenspaces, and invariant subspaces. The methodology involves a combination of rigorous mathematical proofs and derivations, supplemented by illustrative examples that exhibit these discovered symmetry properties in tangible mathematical scenarios. The core findings uncover unique symmetry attributes. For linear algebraic systems with semiring scalar multiplication, we reveal eigenvectors and eigenvalues. Systems operating under near-ring scalar multiplication disclose unique invariant subspaces. These discoveries drastically broaden the traditional landscape of symmetry properties in linear algebraic systems. With the application of these findings, potential practical implications span across various fields such as physics, coding theory, and cryptography. They could enhance error detection and correction codes, devise more secure cryptographic algorithms, and even influence theoretical physics. This expansion of applicability accentuates the significance of the presented research. The research paper thus contributes to the mathematical community by bringing forth perspectives on linear algebraic systems and their symmetry properties through the lens of non-canonical scalar multiplication, coupled with an exploration of practical applications.

Keywords : eigenspaces, eigenvectors, invariant subspaces, near-rings, non-canonical scalar multiplication, semirings, symmetry properties

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