



Bicomplex Modules with Indefinite Inner Product

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Abstract. In this article we provide a systematic investigation of bicomplex indefinite inner product modules. Based on the partial ordering defined on the set of hyperbolic numbers, we classify the elements of the modules into positive, negative and neutral types. Our study includes the orthogonality, isotropic elements, maximal non-degenerate submodule, maximal semi definite submodule and ortho-complemented submodules of bicomplex inner product modules. We then decompose such a module fundamentally into a positive definite, a negative definite and a neutral submodules that ensures the existence of a fundamental symmetry associated with a positive definite inner product for non-degenerate case.

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1. Introduction

The theory of bicomplex numbers is a matter of active research in recent times. The set of these numbers is a real four dimensional space that has been studied for a long time with the seminal works of Segre [1], Dragoni [2] and Spampinato [3,4]. Aiming the possible generalizations of complex numbers, the set of bicomplex numbers becomes a viable commutative alternative of noncommutative skew field of quaternions, an another real four dimensional space. Unlike the quaternions, the multiplication of bicomplex numbers is commutative and in fact the set of later numbers is a ring with zero divisors.

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