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SEMI-RIEMANNIAN FOLIATIONS AND SUBMERSIONS IN QUATERNION-LIKE GEOMETRIES

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Abstract

The paraquaternionic structures, firstly named quaternionic structures of second kind, have been introduced in geometry by P. Libermann [C.R. Acad. Sc. Paris 234 (1952)]. The theory of paraquaternionic manifolds parallels the theory of quaternionic manifolds, but uses the algebra of paraquaternionic numbers, in which two generators have square 1 and one generator has square -1. Accordingly, such manifolds are equipped with a subbundle of rank 3 in the bundle of the endomorphisms of the tangent bundle, locally spanned by two almost product structures and one almost complex structure. From the metric point of view, the almost paraquaternionic Hermitian manifolds have neutral signature [E. Garcia-Rio, Y. Matsushita, R. Vazquez-Lorenzo, Rocky Mt. J. Math. 31 (2001)]. The counterpart in odd dimension of paraquaternionic geometry was introduced by S. Ianuș, R. Mazzocco and G.E.Vîlcu [Mediterranean J. Math. 3(2006)]. It is called mixed 3-structure and appears in a natural way on lightlike hypersurfaces in paraquaternionic manifolds. During this talk, we investigate some special classes of submanifolds in manifolds endowed with paraquaternionic and mixed 3-structures which naturally come equipped with some canonical foliations. In particular, some characterizations are provided for these foliations to become semi-Riemannian, i.e. with bundle-like metric. Moreover, we introduce a new class of semi-Riemannian submersions from a manifold endowed with a metric mixed 3-structure onto an almost paraquaternionic Hermitian manifold. We obtain some fundamental properties and discuss the transference of structures and the geometry of the fibers. In particular, we derive that such a submersion is a harmonic map, provided that the total space is mixed 3-cosymplectic or mixed 3-Sasakian. Several non-trivial examples are given.

Date : Thursday, June 25, 2020

Time: 15:00

Place: IMBM Seminar Room, Boğaziçi University South Campus