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*Examples of induced structures on submanifolds in Riemannian manifolds with special structures*

**Abstract:** The purpose of this paper is to give an effective construction for induced structures on product of spheres of codimension  $r$  in an Euclidean space (of dimension  $m$ ,  $m > r$ ) endowed with an  $(a, \varepsilon)f$  Riemannian structure or a golden structure.

First of all, we consider a  $m$ -dimensional Riemannian manifold  $\widetilde{M}$  endowed with a pair  $(\widetilde{P}, \widetilde{g})$ , where  $\widetilde{g}$  is a Riemannian metric and  $\widetilde{P}$  is an  $(1,1)$  tensor field such that  $\widetilde{P}^2 = \varepsilon Id$ ,  $\varepsilon \in \{1, -1\}$  (where  $Id$  is the identity on  $\widetilde{M}$ ) and it satisfies  $\widetilde{g}(\widetilde{P}U, \widetilde{P}V) = \widetilde{g}(U, V)$  for every tangent vector fields  $U, V \in \chi(\widetilde{M})$ . The pair  $(\widetilde{P}, \widetilde{g})$  induces on any submanifold  $M$  of codimension  $r$  in  $\widetilde{M}$  ( $r < m$ ), a structure denoted by  $(P, g, \xi_\alpha, u_\alpha, a_{\alpha\beta})$ , where  $P$  is an  $(1,1)$ -tensor field on  $M$ ,  $\xi_\alpha$  are tangent vector fields on  $M$ ,  $u_\alpha$  are 1-forms on  $M$  and  $a := (a_{\alpha\beta})_r$  is a  $r \times r$  matrix where its entries are real functions on  $M$  ( $\alpha, \beta \in \{1, \dots, r\}$ ). These structures generalize the almost  $r$ -contact and  $r$ -paracontact structures. We called this kind of structure an  $(a, \varepsilon)f$  Riemannian structure.

Secondly, we define a golden structure on a Riemannian manifolds  $(\widetilde{M}, \widetilde{g})$ , determined by an  $(1,1)$ -tensor field  $\widetilde{P}$  on  $\widetilde{M}$  which satisfies the equation  $\widetilde{P}^2 = \widetilde{P} + Id$  (the same equation as that satisfied by the golden number), and  $\widetilde{g}(\widetilde{P}U, \widetilde{P}V) = \widetilde{g}(\widetilde{P}U, V) + \widetilde{g}(U, V)$  (for every tangent vector fields  $U, V \in \chi(\widetilde{M})$ ). The pair  $(\widetilde{P}, \widetilde{g})$  induces on any submanifold  $M$  of codimension  $r$  in  $\widetilde{M}$ , a structure similar to that above mentioned.

Finally, examples of this kind of structures induced on product of spheres of codimension  $r$  in a  $m$ -dimensional Euclidian space ( $r < m$ ) are constructed.

MSC2000: 53B25, 53C15.

Key words: geometric structures, induced structures, submanifolds in Riemannian manifolds.