

Turkish Journal of Mathematics

Turkish Journal

of

Mathematics

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Applications of the Golden Ratio on Riemannian Manifolds

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Abstract: The Golden Ratio is a fascinating topic that continually generates new ideas. The main purpose of the present paper is to point out and find some applications of the Golden Ratio and of Fibonacci numbers in Differential Geometry. We study a structure defined on a class of Riemannian manifolds, called by us a Golden Structure. A Riemannian manifold endowed with a Golden Structure will be called a Golden Riemannian manifold. Precisely, we say that an $(1,1)$ -tensor field \tilde{P} on a m -dimensional Riemannian manifold (\tilde{M}, \tilde{g}) is a Golden Structure if it satisfies the equation $\tilde{P}^2 = \tilde{P} + I$ (which is similar to that satisfied by the Golden Ratio ϕ) where I stands for the $(1,1)$ identity tensor field. First, we establish several properties of the Golden Structure. Then we show that a Golden Structure induces on every invariant submanifold a Golden Structure, too. This fact is illustrated on a product of spheres in an Euclidean space.

Key Words: Riemannian manifold, Golden Structure, induced structures on submanifolds, Golden Ratio

Turk. J. Math., **33**, (2009), 179-191.

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