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On Deszcz Symmetries

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As a generalization of the spaces of constant curvature Cartan introduced *the locally symmetric spaces*, characterized by the condition $\nabla R = 0$. The integrability condition of $\nabla R = 0$ is $R \cdot R = 0$. The spaces for which $R \cdot R = 0$ holds at every point are called *semi-symmetric* by Szabó. As a natural extension of the semi-symmetric spaces, Deszcz introduced *the pseudo-symmetric spaces* which is called *Deszcz-symmetric spaces*. It is characterized by the condition $R \cdot R = L_R Q(g, R)$, where L_R is the some function and $Q(g, R)$ is the Tachibana tensor. Following Kowalski-Sekizawa when for a pseudo-symmetric space M the function L_R is constant, then M is said to be *pseudo-symmetric of constant type*.

In this work, based on Schouten's interpretation of the Riemann- Christoffel curvature tensor R, a geometrical meaning for the tensor $R \cdot R$ is given. Using this, in analogy with the definition of the sectional curvature $K(p, \pi)$, a scalar curvature invariant $L(p, \pi, \bar{\pi})$ is constructed. This invariant can be geometrically interpreted in terms of the parallelogramoïds of Levi-Civita and it is shown that it completely determines the tensor $R \cdot R$.

Further, it is demonstrated that the isotropy of this new scalar curvature invariant $L(p, \pi, \bar{\pi})$ with respect to both the planes π and $\bar{\pi}$ amounts to the Riemannian manifold to be Deszcz symmetry.

In addition, geometrical characterizations are presented for the tensor $R \cdot S$. The Ricci curvatures are extended to the Ricci curvatures of Deszcz and of which the isotropy determines that M is *Ricci pseudo-symmetric in the sense of Deszcz*, so called *Deszcz Ricci-symmetric*.

Finally, some results on Kaehler manifolds will be presented.