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Chebyshev Nets Formed by Ricci Curves in a 3-Dimensional Weyl Space

An n-dimensional differentiable manifold W_n is said to be a Weyl space if it has a conformal metric tensor g_{ij} and a symmetric connection ∇_γ satisfying the compatibility condition given by the equation

$$\nabla_\gamma\, g_{\alpha\beta} - 2\, T_\gamma\, g_{\alpha\beta} = 0 \ ,$$

where T_γ denotes a covariant vector field. Under the renormalization

$$\widetilde{g} = \lambda^2\, g$$

of the metric tensor g, T is transformed by the law

$$\widetilde{T}_\gamma = T_\gamma + \partial_\gamma \ln\lambda$$

where λ is a function defined on W_n.

Let R_{ij} be the components of the Ricci tensor of the 3-dimensional Weyl space $W_3(g,T)$ and let $R_{(ij)}$ be the symmetric part of R_{ij}. Let the principal directions and the corresponding principal values of $R_{(ij)}$ be denoted, respectively, by $\underset{1}{v},\ \underset{2}{v},\ \underset{3}{v}$ and $\underset{1}{M}, \underset{2}{M}, \underset{3}{M}$. Then, We get

$$(R_{(ij)} + \underset{r}{M}\, g_{ij})\, \underset{r}{v}^{\,i} = 0 \quad , (i, r = 1, 2, 3)$$

We call $\underset{1}{v},\ \underset{2}{v}$ and $\underset{3}{v}$ the Ricci's principal directions and the integral curves of theese vector fields will be named as the Ricci curves of $W_3(g,T)$. Theese curves may be considered as the generalization of Ricci curves in a Riemannian space.

In this paper, it is shown that any 3-dimensional Chebyshev net formed by the three families of Ricci curves in a $W_3(g,T)$ having a definite metric and a Ricci tensor is either a geodesic net or it consists of a geodesic subnet the member of which have vanishing second curvatures. In the case of an indefinite Ricci tensor only one of the members of the geodesic subnet under consideration has a vanishing second curvature.

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