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Riemannian geometry imposed on Friedmann and more general spacetimes

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At first we define Riemannian geometry in general relativity (GR) as geometry determined by Riemannian, Finsler-like metric
\begin{equation}
h_{ab}(x;v) :=2V_a V_b - g_{ab}(x).
\end{equation}
Here g_{ab} is the Lorentzian metric of a spacetime and $\vec{v}$ is an unit timelike vector field: $v = \sqrt{g_{ab}v^a v^b} = 1$. Then, we compare this Riemannian geometry with original, Lorentzian geometry in the case of Friedmann and more general spacetimes

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