

The Riemannian curvature identities on almost Calabi-Yau with torsion 6-manifold and generalized Ricci solitons

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Abstract: We show that on a compact almost complex Calabi-Yau with torsion 6-manifold the Nijenhuis tensor is parallel with respect to the torsion connection ∇ and the torsion is closed if and only if its Ricci tensor is equal to the covariant derivative of the Lee form. If the torsion is closed then the space is a compact generalized gradient Ricci soliton and this is equivalent to a certain vector field to be ∇ -parallel. In particular, this vector field is an infinitesimal automorphism of the ACYT structure. The torsion is closed and the torsion connection ∇ is Ricci-flat if and only if either the norm of the torsion or the Riemannian scalar curvature is constant. On a compact almost complex Calabi-Yau with torsion 6-manifold it is shown that the curvature of the torsion connection $R \in S^2\Lambda^2$ and has vanishing Ricci tensor if and only if it satisfies the Riemannian first Bianchi identity (Kähler-like) which happens exactly when the torsion is closed and parallel with respect to the torsion connection. In the complex case, it follows that the curvature of the Strominger-Bismut connection on a six-dimensional CYT space satisfies the conditions $R \in S^2\Lambda^2, Ric = 0$ if and only if it is Kähler-like.

Acknowledgements

Joint work with Nikola Stanchev is based on [1].

Supported by Contract KP-06-H72-1/05.12.2023 with the National Science Fund of Bulgaria, the National Science Fund of Bulgaria, National Scientific Program "VIHREN", Project KP-06-DV-7 and Contract 80-10-192 / 17.5.2023 with the Sofia University "St.Kl.Ohridski".

References

- [1] S. Ivanov, N. Stanchev, *The Riemannian curvature identities on Almost Calabi-Yau with torsion 6-manifold and generalized Ricci solitons*, arXiv:2307.05001, to appear in Ann.mat. pura appl.