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Parallelism of shape operator on real hypersurfaces in complex two-plane Grassmannians

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A main objective in submanifold geometry is the classification of homogeneous hypersurfaces. Homogeneous hypersurfaces arise as principal orbits of cohomogeneity one actions, and so their classification is equivalent to the classification of cohomogeneity one actions up to orbit equivalence. Actually, the classification of cohomogeneity one actions in irreducible simply connected Riemannian symmetric spaces of noncompact type was obtained by J. Berndt and Y.J. Suh (for complex two-plane Grassmannian $G_2(\mathbb{C}^{m+2}) = SU(m+2)/S(U(2)U(m))$, [1]).

From this, J. Berndt and Y.J. Suh [2] classified real hypersurfaces with isometric Reeb flow in $G_2(\mathbb{C}^{m+2})$, $m \geq 3$. It can be described as a tube over a totally geodesic $G_2(\mathbb{C}^{m+1}) = SU(m+1)/S(U(2)U(m-1))$ in $G_2(\mathbb{C}^{m+2})$. Moreover, H. Lee and Y.J. Suh [6] gave a classification of Hopf real hypersurfaces in $G_2(\mathbb{C}^{m+2})$ with $\xi \in \mathcal{Q}$. Here, the tangent vector field ξ defined by $JN = -\xi$ and the distribution $\mathcal{Q}$ is an orthogonal complement of $\mathcal{Q}^{\perp} = \text{Span}\{\xi_\nu \,|\, \xi_\nu = -J_\nu N\}$ on TM.

In this talk, by using these results, we want to introduce a notion of the Reeb parallel shape operator with respect to the Levi-Civita connection (or the generalized Tanaka-Webster connection [3], resp.) of a real hypersurface in $G_2(\mathbb{C}^{m+2})$ and give some characterizations for these model spaces related to the parallelism of shape operator (see [4], [5], and so on).

Keywords. Complex two-plane Grassmannian, real hypersurface, parallel shape operator, Reeb parallel shape operator, generalized Tanaka-Webster connection.

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