

Real submanifolds of codimension 2 of a complex space form

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Let M be a real submanifold of a complex manifold \overline{M} and J be the natural almost complex structure of \overline{M} . For $x \in M$, we call the subspace $H_x(M) = JT_x(M) \cap T_x(M)$ of the tangent space $T_x(M)$ the holomorphic tangent space of M . If the holomorphic tangent space has constant dimension with respect to $x \in M$, the submanifold is called a CR submanifold and the constant complex dimension is called the CR dimension of M .

It is well known that an n -dimensional real hypersurface of a complex manifold is a CR submanifold of CR dimension $\frac{n-1}{2}$.

We consider now real submanifolds of codimension 2 of a complex manifold. Then contrary to real hypersurfaces, the submanifolds are something complicated. They are not only CR submanifolds of CR dimension $\frac{n-2}{2}$, but also some other cases. For example a complex hypersurface is a real submanifold of codimension 2. Moreover there exists a submanifold which is not CR submanifold. However, to investigate even dimensional real submanifolds of complex manifold, codimension 2 case is fundamental.

We investigate real submanifolds of codimension 2 of a complex manifold under the condition that

$$h(FX, Y) + h(X, FY) = 0 \quad (*)$$

and obtained the following results.

Theorem 1. If a complex hypersurface M of a Kähler manifold \overline{M} satisfies the condition (*), M is a totally geodesic submanifold.

Theorem 2. Let \overline{M} be a non Euclidean complex space form. If a real submanifold M of codimension 2 satisfies the condition (*), then one of the following holds.

- (1) M is a totally geodesic complex hypersurface.
- (2) M is a CR submanifold of CR dimension $\frac{n-2}{2}$ with $\lambda = 0$.

Theorem 3. Let M be a real submanifold of codimension 2 of complex Euclidean space $\mathbf{C}^{\frac{n+2}{2}}$ which satisfies the condition (*). Then M is one of the following:

- (1) M is an n -dimensional Euclidean space \mathbf{E}^n ,
- (2) M is an n -dimensional sphere \mathbf{S}^n ,
- (3) M is a product of an even dimensional sphere with Euclidean space $\mathbf{S}^r \times \mathbf{E}^{n-r}$
- (4) M is a CR submanifold of CR dimension $\frac{n-2}{2}$ with $\lambda = 0$.

Where λ is a function defined on the submanifold M .