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On the Number of Complete Intersection Calabi-Yau Manifolds

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Abstract. The intersection numbers and the action of the Pontryagin class on the integral cohomology are used to distinguish between the many CICY manifolds that have the same Hodge numbers. It is shown by examining manifolds embedded in fewer than six projective spaces that at least 2590 of the manifolds are distinct.

Complete intersection Calabi–Yau manifolds are Calabi-Yau manifolds that can be realized as a complete intersection of polynomials in a product of projective spaces. The prototype of such a space is the manifold introduced by Tian and Yau [1]

$$\begin{matrix}\mathbb{P}_3\\ \mathbb{P}_3\end{matrix}\begin{pmatrix}3 & 0 & 1\\ 0 & 3 & 1\end{pmatrix}.$$

The notation denotes that three polynomials, with multidegrees corresponding to the columns of the matrix, act in $\mathbb{P}_3 \times \mathbb{P}_3$.

A specific choice of such polynomials is:

$$\sum_{i=1}^{4} x_i^3 = 0 \quad \begin{pmatrix}3\\0\end{pmatrix},$$

$$\sum_{i=1}^{4} y_i^3 = 0 \quad \begin{pmatrix}0\\3\end{pmatrix},$$

$$\sum_{i=1}^{4} x_i y_i = 0 \quad \begin{pmatrix}1\\1\end{pmatrix}.$$

This construction was generalized in [2] and [3] to the case that N polynomials p^α, $\alpha = 1, \ldots, N$, have transverse intersection in the product of F projective spaces of