Higher order dual and polar varieties

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Abstract

Let $X \subset \mathbb{P}^N$ be a projective variety of dimension m. For $x \in X$, there is a sequence of osculating spaces to X at x:

$$\{x\} \subseteq T_x \subseteq \mathrm{Osc}_x^2 \subseteq \mathrm{Osc}_x^3 \subseteq \cdots \subseteq \mathbb{P}^N.$$

If $\dim \mathrm{Osc}_x^k < N$ for a general point $x \in X$, then the *kth dual variety* $X^{(k)} \subset (\mathbb{P}^N)^\vee$ of X is the set of hyperplanes containing a kth osculating space to X. The *higher order polar varieties* of X are obtained by imposing Schubert conditions on the osculating spaces, similar to the classical case. The *higher reciprocal polar varieties* are obtained by imposing Schubert conditions on the "Euclidean" normal spaces to the osculating spaces. I will give examples of this theory, with special emphasis on toric varieties.