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5. Differential Geometry and Global Analysis

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Konnov, Valery V., Samara State Pedagogical University, Russia

Differential geometry of algebraic manifolds

The algebraic hypersurface X of degree p in n-dimensional projective space P^n is defined by the equation: $X_{i_1 i_2 \ldots i_p} x^{i_1} x^{i_2} \ldots x^{i_p} = 0$. The set M of all such surfaces is N-dimensional ($N = C^p_{n+p} - 1$) projective space $(P^N)^*$, on which the n-dimensional projective group works. If $\{U^0, U^1, \ldots, U^n\}$ is a frame in $(P^n)^*$, the forms $U^{i_1 i_2 \ldots i_p} = U^{(i_1} \otimes U^{i_2} \otimes \ldots \otimes U^{i_p)}$ will form basis in M, $X = X_{i_1 i_2 \ldots i_p} U^{i_1 i_2 \ldots i_p}$, $dU^i = -\omega^i_j U^j$, $d\omega^i_j = \omega^k_j \wedge \omega^i_k$, $dU^{i_1 i_2 \ldots i_p} = -\omega^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_p} U^{j_1 j_2 \ldots j_p}$, $\omega^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_p} = p\omega^{(i_1}_{(j_1} \delta^{i_2}_{j_2} \ldots \delta^{i_p)}_{j_p)}$. The differential geometry of some algebraic submanifolds in manifolds M is studied in the work. The elementary examples:

On P^1: the variety of all quadrics is the *hyperbolic plane*; the variety of imaginary quadrics is the *Lobachevskian plane*; the variety of degenerating quadrics is the *quadric-absolute*.

On P^2: the variety of degenerating quadrics is the *cubic symmetroid* in P^5.

On P^n: the variety of algebraic hypersurfaces of degree p and rank 1 is the *Veronese manifold* V^n_p in P^N.