THE POLAR CURVES OF PLANE ALGEBRAIC CURVES IN THE GALOIS FIELDS*

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By imitating the proofs in Fine's *College Algebra* (pp. 460–462) and Veblen and Young's *Projective Geometry* (vol. I, pp. 255–256) we can readily show that also in the Galois fields of order p^n (p a prime integer) we have Taylor's expansion

$$
\begin{aligned}
f(x+\lambda X,\ y+\lambda Y,\ z+\lambda Z)
&\equiv f(x, y, z) + \frac{\lambda}{1!}(f_x' X + f_y' Y + f_z' Z) \\
&\quad + \frac{\lambda^2}{2!}(f_x' X + f_y' Y + f_z' Z)^{(2)} + \cdots \\
&\quad + \frac{\lambda^r}{r!}(f_x' X + f_y' Y + f_z' Z)^{(r)} + \cdots + f(X, Y, Z) = 0,
\end{aligned}
$$

where $(f_x' X+f_y' Y+f_z' Z)^{(i)}$ is symbolic for an expression containing derivatives of the ith order, and $f(x, y, z)=0$ is an algebraic curve of order n. In the above expansion we must take all the derivatives as though p were not a modulus, cancel out common factors from numerators and denominators, and then set $p=0$.

The rth polar of (X, Y, Z) with respect to $f(x, y, z)=0$ is

$$\frac{1}{r!}(f_x' X + f_y' Y + f_z' Z)^{(r)} = 0.$$

In particular the rth polar of $(1, 0, 0)$ is $(1/r!)\partial^r f(x, y, z)/\partial x^r = 0$. We suppose first of all that n has the value

$$n = \alpha p^m + \beta p^{m-1} + \cdots + \gamma p^2 + \delta p + \epsilon, \qquad \epsilon \neq 0, \quad p = \epsilon + \zeta, \quad \zeta \neq 0.$$

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