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For any ξ_1 and ξ_2 satisfying

$$\xi = \eta + t\delta, \quad (A\xi, \xi) = 0$$

and corresponding t_1 and t_2 of (2.2) for which $|t_1| \cdot |t_2| = |t'|^2$ [see 3 III], there is a point ξ called the harmonic conjugate of η with respect to ξ_1 and ξ_2 , so that the parameter t corresponding to this ξ satisfies the harmonic relation

$$\frac{2}{|t|} = \frac{1}{|t_1|} + \frac{1}{|t_2|}.$$

This implies that the image of t in the complex plane is the polar of the origin with respect to the image of t_0 , defining the intersection of the line $\xi = \eta + t_0\delta$ and $(A\xi, \xi) = 0$. Thus

$$t = -\frac{(A\eta, \eta)}{(A\eta, \delta)}, \quad (A\eta, \delta) \neq 0.$$

If $(A\eta, \delta) = 0$, then the polar is at infinity. Substituting this t in (9.1) we get

$$\overline{(A\eta, \delta)} \xi = \overline{(A\eta, \delta)} \eta - (A\eta, \eta) \delta.$$

From the inner product of both sides with $A\eta$ we get

$$\overline{(A\eta, \delta)} (A\eta, \xi) = 0,$$

and since $(A\eta, \delta) \neq 0$ we get $(A\eta, \xi) = 0$, the equation of a plane called the polar of η with respect to the quadric.

Note that if η is on the quadric, then this plane becomes the tangent plane.

In this paper we have discussed only the properties of a quadric in any location. The problem of transformation to the most convenient position is well known, and we made use of it in section 7.

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