Rank-65873 over GF(4)

January 15, 2021

The equation

The equation of the surface is :

$$X_1^3 + X_2^3 + X_3^3 + X_0^2X_3 + X_1^2X_2 + X_0X_1X_2 = 0$$

(0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0)
The point rank of the equation over GF(4) is 1431725485

General information

Number of lines	1
Number of points	21
Number of singular points	1
Number of Eckardt points	0
Number of double points	0
Number of single points	5
Number of points off lines	16
Number of Hesse planes	0
Number of axes	0
Type of points on lines	5
Type of lines on points	1^5, 0^{16}

Singular Points

The surface has 1 singular points:

$0: \ P_{23} = \mathbf{P}(1,0,0,1) = \mathbf{P}(1,0,0,1)$

The 1 Lines

The lines and their Pluecker coordinates are:

$$\ell_0 = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}_{89} = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}_{89} = \mathbf{Pl}(1,1,1,1,1,0)_{74}$$

Rank of lines: (89)
Rank of points on Klein quadric: (74)

Eckardt Points

The surface has 0 Eckardt points:

Double Points

The surface has 0 Double points:
The double points on the surface are:

Single Points

The surface has 5 single points:
The single points on the surface are:

$0: P_{12} = (1,1,1,0)$ lies on line ℓ_0
$1: P_{23} = (1,0,0,1)$ lies on line ℓ_0
$2: P_{42} = (0,1,1,1)$ lies on line ℓ_0
$3: P_{64} = (3,2,2,1)$ lies on line ℓ_0
$4: P_{83} = (2,3,3,1)$ lies on line ℓ_0

The single points on the surface are:

Points on surface but on no line

The surface has 16 points not on any line:
The points on the surface but not on lines are:

$0: P_0 = (1,0,0,0)$
$1: P_4 = (1,1,1,1)$
$2: P_{17} = (2,2,1,0)$
$3: P_{22} = (3,3,1,0)$
$4: P_{26} = (0,1,0,1)$
$5: P_{30} = (0,2,0,1)$
$6: P_{34} = (0,3,0,1)$
$7: P_{38} = (0,0,1,1)$
$8: P_{53} = (0,0,2,1)$
$9: P_{58} = (1,1,2,1)$
$10: P_{60} = (3,1,2,1)$
$11: P_{61} = (0,2,2,1)$
$12: P_{69} = (0,0,3,1)$
$13: P_{74} = (1,1,3,1)$
$14: P_{75} = (2,1,3,1)$
$15: P_{81} = (0,3,3,1)$

Line Intersection Graph

	0
0	0

Neighbor sets in the line intersection graph:
Line 0 intersects

Line
in point

The surface has 21 points:
The points on the surface are:

$0:\ P_0 = (1,0,0,0)$
$1:\ P_4 = (1,1,1,1)$
$2:\ P_{12} = (1,1,1,0)$
$3:\ P_{17} = (2,2,1,0)$
$4:\ P_{22} = (3,3,1,0)$
$5:\ P_{23} = (1,0,0,1)$
$6:\ P_{26} = (0,1,0,1)$
$7:\ P_{30} = (0,2,0,1)$
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$16:\ P_{69} = (0,0,3,1)$
$17:\ P_{74} = (1,1,3,1)$
$18:\ P_{75} = (2,1,3,1)$
$19:\ P_{81} = (0,3,3,1)$
$20:\ P_{83} = (2,3,3,1)$