

CZ2003 Tutorial 4 (2022/23, Semester 1)

Planes, polygons and bilinear surfaces

1. Using an equation in intercepts, write an implicit equation of the plane which intersects the Cartesian coordinate axes X, Y and Z at the three points with coordinates $P_1=(1, 0, 0)$, $P_2=(0, 3, 0)$ and $P_3=(0, 0, 6)$, respectively. **Display the plane and attach a screenshot of ShapeExplorer.**
2. Write an implicit equation of a plane which passes through the point with Cartesian coordinates $(1, 2, -3)$ while being orthogonal to the straight line defined by $x = u + 2$, $y = u - 1$, $z = 3u + 1$, $u \in (-\infty, \infty)$. **Display the plane and attach a screenshot of ShapeExplorer.**
3. Propose how to define parametrically with functions $x(u, v)$, $y(u, v)$, $z(u, v)$ a plane passing through points with coordinates $(-3, 0, 0)$, $(0, 2, 0)$, $(0, 0, 4)$. Display the plane and attach a screenshot of ShapeExplorer.
4. (a) A bilinear surface is defined by four points $P_1=(-1, 1, -1)$, $P_2=(1, 0, -1)$, $P_3=(-1, 0, 1)$ and $P_4=(1, 0.5, 1)$ and two parametric coordinates $u \in [0, 1]$ and $v \in [0, 1]$, as illustrated in Figure Q3. Write parametric equations defining the bilinear surface. **Display the surface and attach a screenshot of ShapeExplorer.**

(b) What are the coordinates of the point with the parametric coordinates 0.2, 0.4?

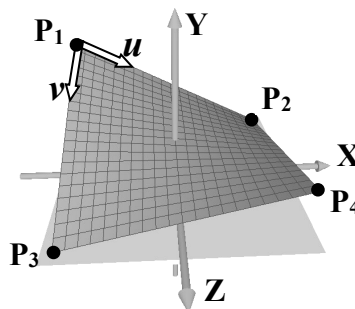


Figure Q3

5. Write parametric equations $x(u, v)$, $y(u, v)$, $z(u, v)$, $u, v \in [0, 1]$ defining a triangular polygon which is bounded by the three segments defined by:
$$\begin{array}{llll} x = 1 + 2u & y = 1 + u & z = 1 - u & u \in [0, 1] \\ x = 3 - u & y = 2 + u & z = 4u & u \in [0, 1] \\ x = 2 - u & y = 3 - 2u & z = 4 - 3u & u \in [0, 1]. \end{array}$$
Display the polygon and attach a screenshot of ShapeExplorer.