Notes of "The Equation of a Plane"

Jinxin Wang

1 Overview

- The equation of a plane
- A geometric interpretation of the coefficients of the general equation of a plane
- Positional relationships between planes
- A geometric interpretation of a linear inequality with three unknowns

2 The equation of a plane

Proposition 1. *In an affine coordinate system, a plane corresponds to a linear equation with three unknowns in which at least one of their coefficients are nonzero, and vice versa.*

证明. Hint: (TODO) □

Remark 1 (The general equation of a plane)**.**

3 A geometric interpretation of the coefficients of the general equation of a plane

Theorem 1. *Given the general equation of a plane:* $Ax + By + Cz + D = 0$*, a vector* $\vec{u} = (u_x, u_y, u_z)$ *is parallel to the plane if and only if*

$$Au_x + Bu_y + Cu_z = 0 \tag{1}$$

证明. Hint: (TODO) □

4 Positional relationships between planes

There are only two kinds of positional relationships between planes:

- Parallel
- Intersected

Example 1. *The intersection of three planes* π_1 :, π_2 :, π_3 *is unique* $\Leftrightarrow \begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix} \neq 0$

5 A geometric interpretation of a linear inequality with three unknowns