N2202781D Nie Yuhe

CZ2003 Computer Graphic and Visual

Tutorial Answer

CZ2003 Tutorial 2 (2022/23, Semester 1)

Mathematical functions in computer graphics

1. Give a definition of mathematical function.

2. What ways of defining mathematical functions do you know?

3. Given an explicit function $y = sin(x) + cos(x)$, propose how to convert it to the respective parametric functions $x = f_1(t)$ $y = f_2(t)$?

4. (i) Given parametric functions $x = sin^2(t)$ and $y = cos(t)$, obtain the respective implicit function $f(x,y) = 0$.

   (ii) Given parametric functions $x = 2 + 3t$ and $y = 3 + t$, obtain the respective implicit function $f(x,y) = 0$.

Q1. Mathematics function associate one quantity, the argument of the function (input) with another quantity, the value of the function (output)

A function assigns exactly one output to each input.

Values from the input domain map to the values of the output domain

Q2.
① Explicit way
eg. $y=f(x)$ $z=f(x,y)$
② Implicit way
eg. $f(x)=0$, $f(x,y)=0$
③ Parametric way
eg. $x=f_x(t)$ $y=f_y(t)$
$x=f_x(u,v)$, $y=f_y(u,v)$

Q3. $y=\sin(x)+\cos(x)$ can be converted into

$$\begin{cases} x=t \\ y=\sin(t)+\cos(t) \end{cases}$$

Q4.

(i) $x = \sin^2(t)$

$y = \cos(t) \Rightarrow x + y^2 = \sin^2(t) + \cos^2(t) = 1$

Then we can find implicit function

$f(x, y) = x + y^2 - 1 = 0$

(ii) $x = 2 + 3t$

$\Rightarrow t = \frac{x-2}{3}$

$y = 3 + \frac{x-2}{3}$

$\Rightarrow 3y = 9 + x - 2$

$\Rightarrow 3y = x + 7$

Then we can find implicit function

$f(x, y) = 3y - x - 7 = 0$