Assignment 8

Wen Sheng
Computer Graphics 578

November 23, 2015

Exercise 1. (478 and 578) Express the point (0,2,0) as a quaternion. Following the steps shown in class for computing the result of a rotation using quaternions, find the result of rotating this point 30 degrees around the line that passes through the origin and the point (1,1,1).

Proof. $\because q_p = (0, \vec{p}),\ q = [cos(\phi/2); sin(\phi/2)\vec{n}], q_p^{'} = q q_p q^{-1}$

Also, $\because \vec{p} = (0, 2, 0),\ \vec{n} = \frac{(1,1,1)}{\sqrt{1^2+1^2+1^2}},\ \phi = 30°$

$\therefore q = (\frac{\sqrt{6}+\sqrt{2}}{4},\ \frac{\sqrt{6}-\sqrt{2}}{4}\vec{n}), q_p = (0, (0, 2, 0)),\ q^{-1} = \big(\frac{\sqrt{6}+\sqrt{2}}{4}, (\frac{\sqrt{6}-3\sqrt{2}}{12}, \frac{\sqrt{6}-3\sqrt{2}}{12}, \frac{\sqrt{6}-3\sqrt{2}}{12})\big)$

$\therefore q q_p = \big(\frac{\sqrt{6}-3\sqrt{2}}{6},\ (\frac{\sqrt{6}-3\sqrt{2}}{6},\ \frac{\sqrt{6}+\sqrt{2}}{2}, \frac{3\sqrt{2}-\sqrt{6}}{6})\big)$

$\therefore q q_p q^{-1} = \big(0, (\frac{2-2\sqrt{3}}{3}, \frac{2+2\sqrt{3}}{3}, \frac{2}{3})\big)$

$\therefore q_p^{'} = (\frac{2-2\sqrt{3}}{3}, \frac{2+2\sqrt{3}}{3}, \frac{2}{3})$ □