Assignment 8

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Computer Graphics 578

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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).

Answer:

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

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

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

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

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

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

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