Assignment 8

Wen Sheng
Computer Graphics 578

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Exercise 2. (478 and 578) Consider a 2D velocity field defined by (vx,vy) = ((y-5)+(5-x)/2), ((5-y)/2 +(5-x)) where the velocity is in m/s. Starting an object at the point (x,y) = 4,6 , plot (using whatever code you want, please include your source) the path of the object moving for 5 seconds using:
a) a time step of 1 second using Euler?s method
b) a time step of 0.1 second using Euler?s method
c) a time step of 1 second using the Mid-Point method d) a time step of 0.1 second using the Mid-point method

Answer:

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

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

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

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

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

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

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