

CSCI 480 Compute Graphics Programming Assignment 2 Simulating a Roller Coaster

For every time step of your simulation, the curve parameter u can be updated using the following equation:

$$u_{new} = u_{current} + (\Delta t) \frac{\sqrt{2g(h_{max} - h)}}{\left\| \frac{dp}{du} \right\|}$$

where Δt is the time step,

g is the gravity constant,

h_{max} is the maximum height of the track,

h is the current height of the roller coaster,

p is a function of u (i.e. $p(u)$) that computes

the position (in 3D) of the roller coaster at $u = u_{current}$ (see

p.628 of the textbook “Interactive Computer Graphics: A Top-Down Approach Using OpenGL” for the exact equation of $p(u)$).

Note that $\frac{dp}{du}$ is the derivative of $p(u)$ with respect to u , and

the derivative is evaluated at $u = u_{current}$. Also, $\left\| \frac{dp}{du} \right\|$ is the magnitude

(i.e. $mag = \sqrt{x^2 + y^2 + z^2}$) of the vector $\frac{dp}{du}$.