

Assessment 1

September 25, 2022

Let us consider Centripetal Catmull-Rom Spline Interpolation in the two-dimensional space. Imagine half-sphere with the center in the origin and the radius r . See the Figure 1. Define the radius r as $r = 10 + \frac{m}{d}$, where m is the number of the month in your birthday date, while d is the day number. Solve the following problems, and explain your solution in details.

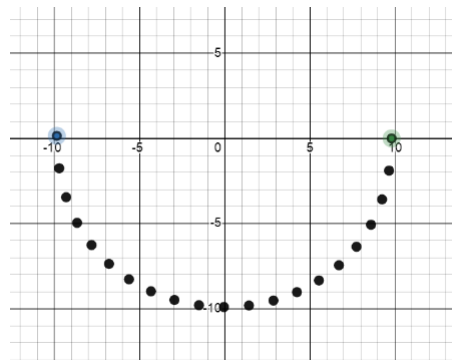


Figure 1: An example of a half-sphere with the diameter $r = 10$.

Problem (a). Let $p_0 = (-r, 0)$ and $p_3 = (r, 0)$. Find the coordinates of p_1 and p_2 in order to interpolate the half-sphere between p_0 and p_3 .

Problem (b). Let $C(s)$ is the interpolated point given by the parameter $s \in [t_0, t_3]$ where $t_0 = 0$. For $C(t_0) = p_0$ and for $C(t_3) = p_3$. Find the points $C(s_i)$ where $i \in \{0, 1, \dots, 19, 20\}$ and $s_i = \frac{i \times (t_3 - t_0)}{20}$. List the points and plot the points onto the graph.

Problem (c). Find the root mean square error where the deviation is derived from the distance between points $C(s_0), C(s_1), \dots, C(s_{20})$ and the hypothetical half-sphere.