

1 Introduction

In this lab we will look at how to perform ray intersection test. The task for this lab is to take a ray and perform the ray intersection test with a sphere and display the point of intersection if it occurs.

Ray is represented in parametric form using point of origin and a direction.

$$p(t) = e + td \quad (1)$$

where t is the parameter e is the eye and d is the direction which can be computed using $s - e$ for an arbitrary point s in space.

2 Ray-Sphere intersection

The intersection test can be conducted simply by calculating the value of t which satisfies the equation for a sphere centered at c defined by $(p - c) \cdot (p - c) - R^2 = 0$

$$(e + td - c) \cdot (e + td - c) - R^2 = 0 \quad (2)$$

$$t = \frac{-d \cdot (c - e) \pm \sqrt{(d \cdot (c - e))^2 - (d \cdot d)((e - c) \cdot (e - c) - R^2)}}{(d \cdot d)} \quad (3)$$

If intersection occurs t the point of intersection can be found using $e + td$. While the number of intersections is governed by the number of real roots.

3 Deliverables

The task for the lab is to calculate t for a given ray and display the point of intersection. Upon ray sphere intersection change the color of the sphere and print the point of intersection. In order to verify display the ray and the point of intersection, you can use the above method and use multiple VAO to display the point in another color. Check for 2 cases one a definite intersection of your choice and another for the random ray generated. Submit the output along with code for evaluation. Further take screenshot to show the result. Upload the zip file of code and output. Name the zip file as Lab05_<name_ roll no>.zip