1. Write the parametric form of the ray (half-line) with origin $\boldsymbol{p}_0$ and direction vector $\boldsymbol{v}$.
2. What is the raycasting algorithm?
3. What parameters determine the camera coordinate system? How can the coordinate axes be computed from these parameters?
4. What parameters determine the size and position of the projection plane in the camera coordinate system?
5. Derive the ray generated from pixel (i, j) in raycasting (origin and direction vector).
6. Why and where are intersection tests needed in raycasting?
7. Describe in general the intersection of a ray and a parametric surface.
8. Describe in general the intersection of a ray and an implicit surface.
9. Describe in general the intersection of a ray and a triangle, given the plane of the triangle and the intersection point of the ray with the plane.
10. Describe in general the intersection of a ray and a polygon, given the plane of the polygon and the intersection point of the ray with the plane. Does the method also work for concave polygons?
11. What is the basic idea of the point–polygon containment test you have studied? How can this test be performed?
12. Derive the intersection point of the ray (with origin $\boldsymbol{p}_0$ and direction vector $\boldsymbol{v}$) and the plane (defined by point $\boldsymbol{q}_0$ and normal $\boldsymbol{n}$).
13. Derive the intersection point(s) of the ray (with origin $\boldsymbol{p}_0$ and direction vector $\boldsymbol{v}$) and the sphere (with center $\boldsymbol{c}$ and radius r).
14. Given a ray with origin $\boldsymbol{p}_0 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ and direction vector $\boldsymbol{v} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, and a sphere with center $\boldsymbol{c} = \begin{bmatrix} 4 \\ 0 \\ 0 \end{bmatrix}$ and radius $r = 2$, find the intersection point of the ray and the sphere. What is the distance between the ray's origin and the intersection point?
15. Given a ray with origin $\boldsymbol{p}_0 = \begin{bmatrix} 4 \\ 4 \\ 0 \end{bmatrix}$ and direction vector $\boldsymbol{v} = \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix}$, and a sphere with center $\boldsymbol{c} = \begin{bmatrix} 4 \\ 0 \\ 0 \end{bmatrix}$ and radius $r = 2$, find the intersection point of the ray and the sphere. What is the distance between the ray's origin and the intersection point?
16. Given a ray and an object transformed by a matrix M, how can the intersection with the transformed object be computed by intersecting the transformed ray with the original (untransformed) object?
17. Define an AAB (*axis-aligned box*). How can a ray be intersected with an AAB?